The Tool Engineer

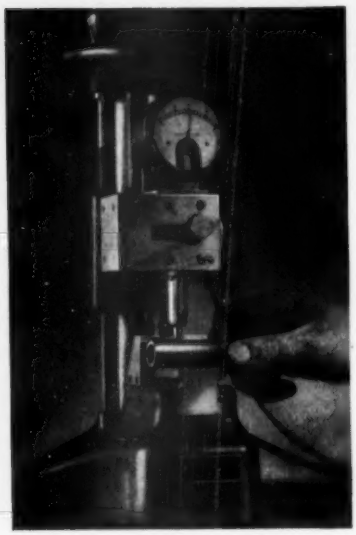
APRIL, 1937

In This Issue

Official Publication of the

AMERICAN SOCIETY OF TOOL ENGINEERS

PRATT & WHITNEY



Above: Electrolimit Gages check and grade wrist pins at 700 per hour.

Electrolimit Gage in the Automotive Industry

THIS most modern instrument for governing production accuracy has won its automotive spurs. In its various forms it has reduced costly inspection to a simple routine. But most of all, because it can sort parts with uncanny speed into accurately matched groups, it has reduced assembly time and troubles tremendously.

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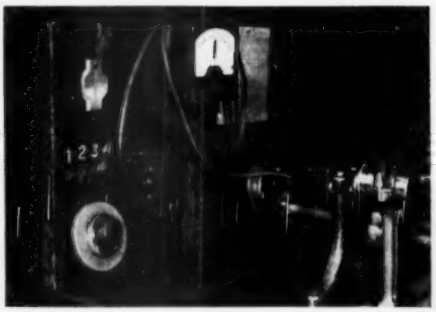
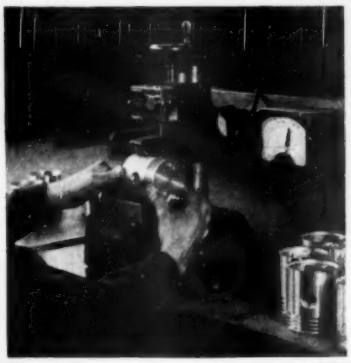
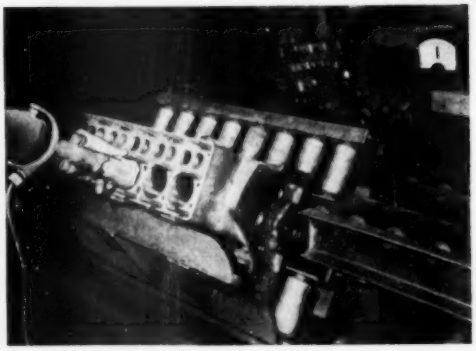


Electrolimit Internal Comparator gaging and grading for selective assembly the crankshaft bore of an automotive connecting rod.

Below: P&W Electrolimit Cylinder Bore Gages measure and grade for selective assembly the bores in automotive cylinder blocks.



Above: P&W Electrolimit Internal Comparator checking and grading the wrist pin hole in automotive pistons for selective assembly.



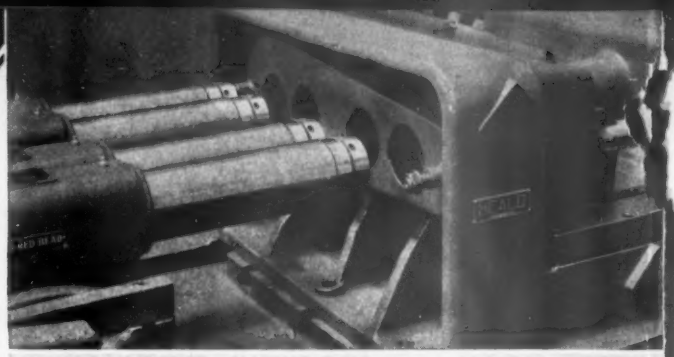
Above: Checking the outside diameter of automotive pistons and grading them for selective assembly, using the P&W Electrolimit Gage.

Right: Electrolimit Internal Gage checking and grading a connecting rod wrist pin hole.

PRECISION BORING In the Automotive Industry with Heald Bore-Matics

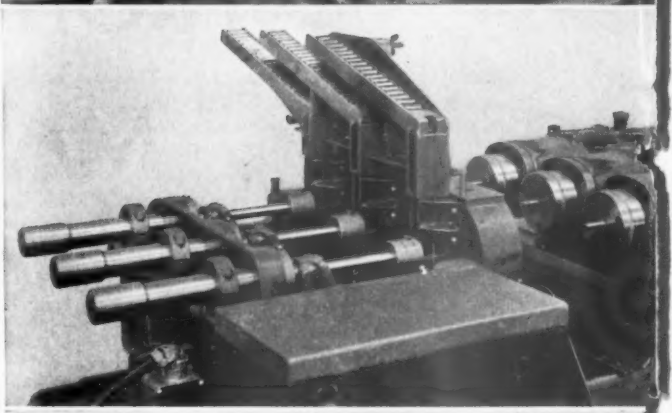
Heald Precision Bore-Matics find wide application in the automobile, truck, tractor, and diesel engine industries.

These machines consistently produce holes to the closest tolerances for size, roundness and straightness. This method produces absolute parallelism of bores such as in cylinder blocks, and holds these bores in perfect squareness with the other surfaces. Spaced holes, too, wrist pin holes in pistons for example, can be held in perfect alignment.



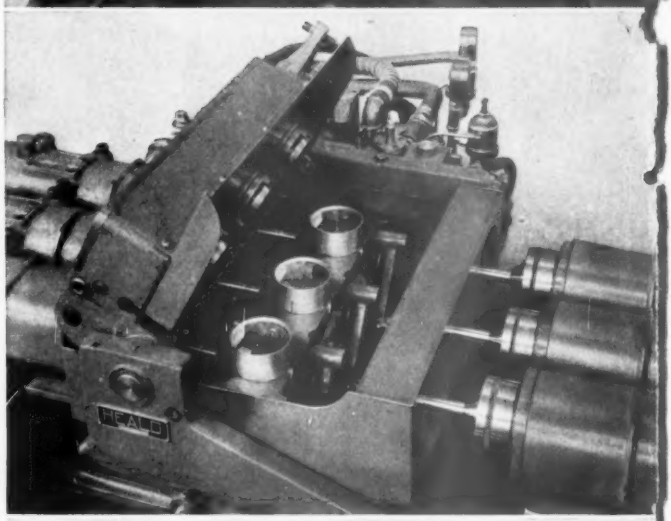
1

A Style No. 45 Bore-Matic precision boring a four en bloc cylinder assuring absolute parallelism of bores and perfect squareness of bores to crankshaft.



2

A Style No. 48 Bore-Matic automatically precision boring valve tappet guides. Operator only has to keep the chutes filled with work.



3

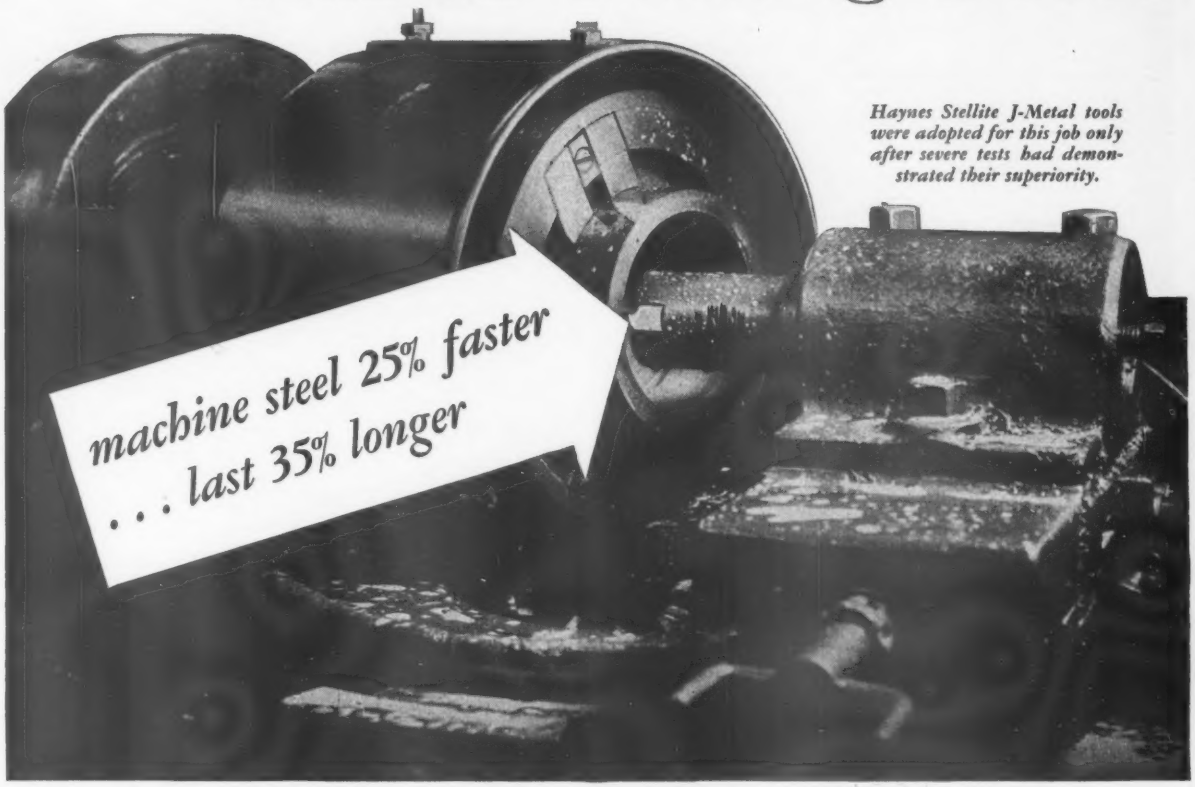
A Style No. 49 Bore-Matic rough and finish boring the wrist pin holes in pistons three at a time. Perfect alignment and squareness is assured.

4

A Style No. 47 Bore-Matic as arranged for handling various miscellaneous tractor parts. Most of these are bearing cages which are both bored and faced.

THE HEALD MACHINE CO., WORCESTER, MASS., U. S. A.

HAYNES STELLITE
J-METAL *Cutting Tools*



Haynes Stellite J-Metal tools were adopted for this job only after severe tests had demonstrated their superiority.

THIS shows a half-inch square Haynes Stellite J-Metal tool rough-boring an outer race for a self-aligning ball bearing, made of SAE 52100 steel. Cutting speed is 144 feet per minute, with a water and oil lubricant. The feed is .009 inches per revolution, with a depth of cut of .020 to .095 inches. The floor-to-floor time per piece is one minute. This represents an increase in production speed of 25 per cent. In addition the Haynes Stellite J-Metal tools last *35 per cent longer between grinds.*

Specific data on applications in which you are interested will be furnished on request, or one of our engineers will be glad to assist you in your machining problems. This service is available without obligation.

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The Tool Engineer

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Official Publication of the AMERICAN SOCIETY OF TOOL ENGINEERS

Vol. V | APRIL, 1937 | No. 12

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Application blanks and information pertaining to membership in the American Society of Tool Engineers may be had by addressing **The Tool Engineer**, 2842 W. Grand Boulevard, Detroit, Michigan, or the Secretary's office, 5928 Second Blvd., Detroit, Michigan. **Dues** are $5 initiation fee, $6 per year for senior grade membership and $3 per year for junior grade membership. Junior membership initiation fee $2.

The Tool Engineer is published on the first Thursday of each month. It is the official publication of the American Society of Tool Engineers, Incorporated. The membership of the Society and readers of this publication are practical manufacturing executives such as master mechanics, works managers, Tool Engineers, tool designers and others who are responsible for production in mass manufacturing plants throughout the nation and in some foreign countries.

Owing to the nature of the American Society of Tool Engineers organization, it cannot, nor can the publishers be responsible for statements appearing in this publication either as papers presented at its meetings or the discussion of such papers printed herein.

Published by
THE BRAMSON PUBLISHING CO.
2842 W. Grand Boulevard MAdison 7553 Detroit, Michigan
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In Train Service or Tool Service

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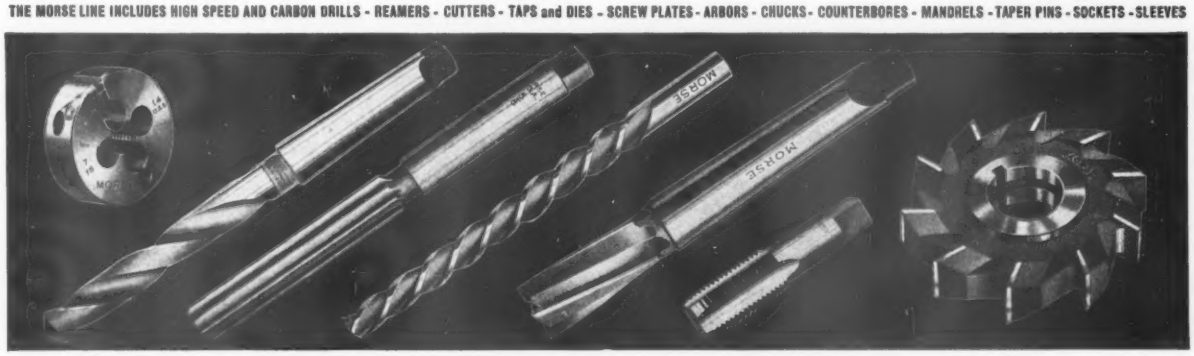

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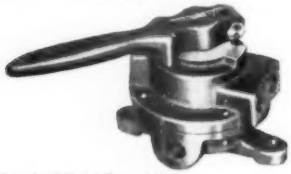
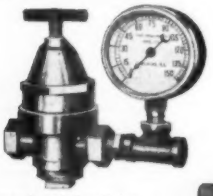
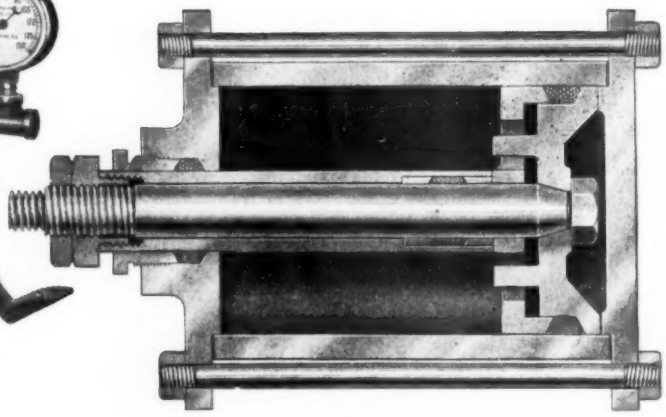


Standard Hand Control Valve



Pressure Regulating Valve



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PNEUMATIC AND HYDRAULIC PRODUCTION TOOL EQUIPMENT

FIVE YEARS OF PROGRESS

By

A. E. RYLANDER

MEMBER A.S.T.E.

CONCEIVED during the depression and fostered through its darkest years, the American Society of Tool Engineers is an example of what can be accomplished when clear-sighted, straight-thinking men sense the need of their fellows and then work to satisfy that need. And, work it has been, but somehow the results seem to justify the expenditure.

It is not my purpose here to write the history of the Society. History is an account of the post, and the A.S.T.E. is a project of the future. The history of this live, growing organization can be epitomized in a phrase—five years of progress in Tool Engineering.

Let us now resolve these five years into terms of actual accomplishment. When the Society was first organized, designers, production engineers, master mechanics, chief draftsmen, and the various men engaged in tooling and metal processing, and in promoting mass production, had as many titles as their employers chose to designate. There was no unity, no co-ordination, few standards that actually related to the science of Tool Engineering. No college, with the exception of the then young and aspiring D.C.A.S., that gave courses in tooling for mass production. No publication devoted itself to tools, except as a sideline.

As a definite accomplishment, then, the A.S.T.E. has embraced the various production and metal processing men into one inclusive group—TOOL ENGINEERS. These men now have professional standing, a higher place in the estimation of their employers. They have become a force to be reckoned with, not of dissension, but of progress, a balance wheel in industrial progress. Lately, colleges and universities have come to acknowledge the need of specialized courses in Tool Engineering, and chairs are being established to promote that science, as prominent heads of leading engineering colleges affiliate with the Society. It is significant that, with growing frequency, employers are advertising for Tool Engineers, not for this and that when men versed in metal processing are wanted.

The A.S.T.E. Standards, with all their potential value to industry, are as yet too embryonic to count as an actual accomplishment. But, like the Society itself, there is need for them, they are wanted. Their reception by the membership, their growing consideration by manufacturers of tools and mechanical equipment clearly establish their place in the scheme of engineering. Then, there is THE TOOL ENGINEER, a messenger of good will that cements the Society's far-flung membership, its growing circle of friends here and abroad. For it goes to many lands, spreading the gospel of good tooling and good fellowship, becoming known as one of the most interesting and one of the friendliest technical publications in the world.

Perhaps, in the final analysis, the greatest accomplishment of the A.S.T.E. is the promotion of good fellowship, of understanding and accord between employer and employee, between management and the men who actually conceive the tools and methods for mass production, and with it, mass employment and prosperity. When the executive rubs elbows with the men on the board, when he "mixes" with men just taking a tentative hold on the ladder of success, there can be only one result—understanding and mutual recognition of human qualities. On that one accomplishment the writer rests his case.

Grow on, then, American Society of Tool Engineers, grow on to greater things, project for the future along the same ideals that have made the Society what it is today—a healthy, progressive, friendly forum for men who do things. Mutual congratulations on this—OUR FIFTH ANNIVERSARY.

DESIGN for PRODUCTION

By O. W. BOSTON

Professor of Metal Processing and Director
of the Department of Metal Processing, University of Michigan

THE initial design of a product is prepared usually by the engineering department of the plant. The engineer should design with the most recent advances in shop technique in mind in order to take the fullest advantage of new processes. In large plants special design divisions handle tools, gages, dies, and jigs and fixtures. The product designed then is submitted for suggestions and agreement to other offices concerned in the features of design, such as:

1. The purchasing department, responsible for material cost
2. The metallurgical department, in charge of specifications of materials and treatment
3. The plant equipment department, in charge of machine tools
4. The tooling department, in charge of work-holding jigs and fixtures, dies, inspection gages, and cutting tools
5. The production department, responsible for manufacturing
6. The inspection department, responsible for quality of the product.

These offices agree on the material of which each part is to be made, the form in which that material shall be purchased, the treatment to which it is to be subjected to meet physical or chemical requirements, various features of design which influence the use of machine tools available or to be purchased, features of design which influence the design of jigs, fixtures, and cutting tools in production, and practical manufacturing tolerance on dimensions.

Detail and assembly drawings are finally prepared in which all features of design, including necessary mathematical calculations or practical considerations for convenience of manufacture are incorporated. The detail drawings of each part are made to show all dimensions, fits, tolerances, and other instructions necessary for its careful manufacture

Fits and Tolerances

In designing, mating parts should be dimensioned in such a way that, after they have been made as individual units, they will fit together and function as desired. When many parts are being made, all should fit interchangeably with the mating parts without further fitting. Frequently, in job-shop work, assemblies are built up by making one part fit the other. This often requires long tedious fitting operations. When occasional assemblies of high precision are desired, they are many times obtained by selective assembly from regular production lots.

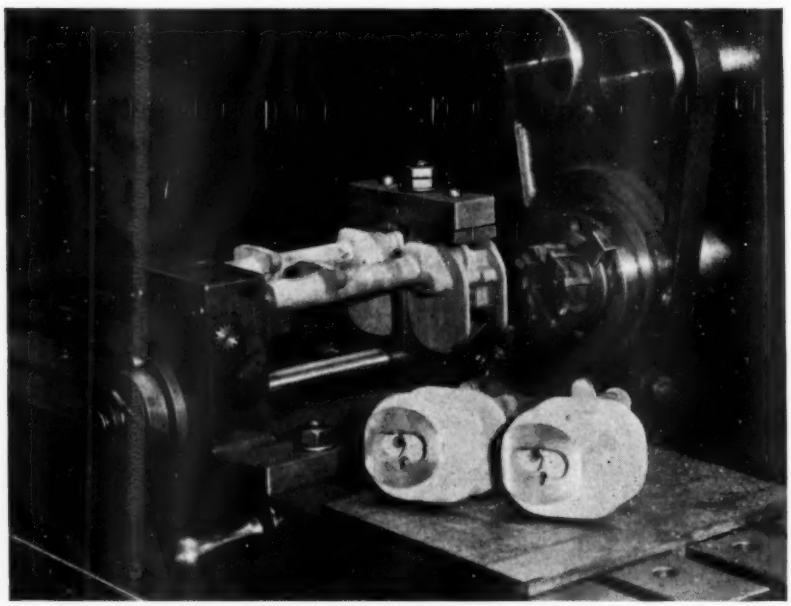
No part can be made to fit another part exactly, nor can all pieces of any part be machined to the same exact size. Fig. 3 shows a shaft and journal properly dimensioned with terms approved by the American Standards Association (B4a, 1925) for gages and metal fits.

The nominal size is that size indicating a close approximation to a standard size, such as ⅛, 1¼, 2 1/16, etc. The nominal size of the shaft and hole in Fig. 3 is 3 inches. The basic size is the exact theoretical size from which all limiting variations are made, as 3.0000 inch for the hole and 2.9981 inch for the shaft.

By tolerance is meant the amount of variation permitted from the basic dimension. Tolerances make it possible to manufacture parts accurately enough to function properly and avoid unnecessary precision which would increase manufacturing cost without a proportionate increase in the practical value of the product. Fig. 3 shows tolerance applied to the basic diameters of the hole and shaft. The tolerance on the hole is above the basic size, but that on the shaft is below unless for force fits.

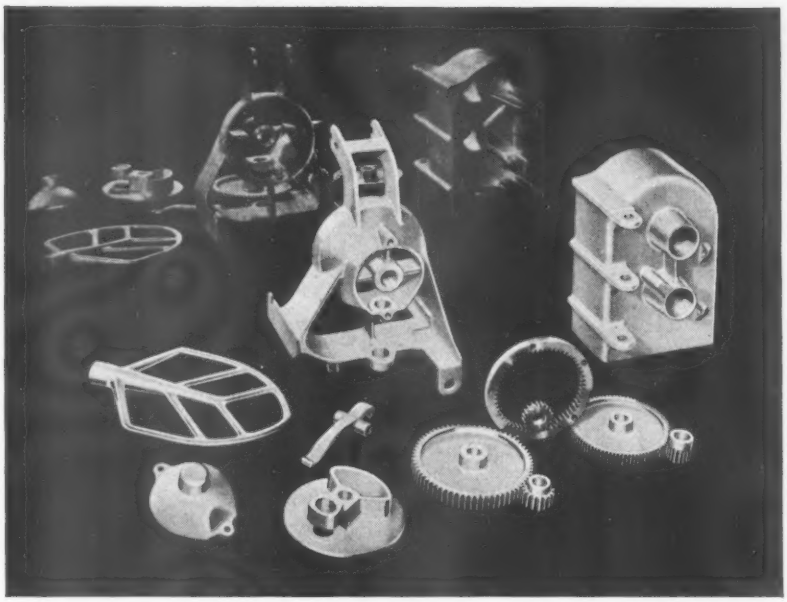
There are two systems of tolerance in common use: the unilateral and bilateral. The unilateral tolerance system, as indicated by the American Standards Association in the illustration above, gives tolerances on only one side of the basic dimension. The bilateral tolerance system indicates tolerances on both sides of the basic dimension. Tolerances are sometimes referred to incorrectly as limits. Limits represent the maximum and minimum dimensions as shown in Fig. 3.

The allowance is the intentional difference in the dimensions of mating parts to provide for different classes of fits. It is the minimum clearance space intended between mating parts, made by the unilateral tolerance system, as 0.0019 inch in Fig. 8. It represents the condition of tightest permissible fit, that is, the largest internal member mated



Courtesy Kearney and Trecker Corporation

Fig. 1. An excellent combination of machine tool, fixture, and cutter for rapid limited production. The fixture is set up on the Milwaukee Simplex miller for facing the ends of two gray iron castings in 20 seconds. A 3-inch K. and T. full power face mill with cemented tungsten carbide tipped blades is used, taking a cut 1/16 inch deep, with a power table feed of 32.5 inches per minute and a peripheral cutting speed of 325 f.p.m. The heavy rigid fixture aligns and locates the work accurately and clamps it securely through the rack and pinion and Schwartz type lock with a slight movement of the operating handle.



Courtesy Newton Die Casting Corporation

Fig. 2. A representative group of aluminum and zinc die castings, showing the influence of careful design on appearance, strength, weight, and service.

with the smallest external member. The basic hole is usually the nominal size and that of the shaft is undersize. On this basis, standard reamers may be used to finish the holes. The shaft size is varied to suit the fit, as shown in Fig. 4. The basic shaft may be used as the nominal size, however, and the hole diameter varied to suit the fit.

The above mentioned A.S.A. standard calls for eight classes of fits as illustrated in Fig. 4 for a basic hole size of 1 inch. The values of allowance and tolerance vary with the basic hole size, as set forth in detail in the standard.

Bill of Material

When the final engineering or manufacturing drawing of a device is finished, a bill of material is prepared. It is usually summarized on an assembly drawing, although the detailed drawing of each part indicates the material for that part. This bill lists the number and name of all parts as numbered on the assembly drawing, the number of each unit needed in the assembly, as well as the type and fabricated form and amount of the material of which that part is to be made. The weights of the rough stock and finished part are sometimes added for convenience. This is used in estimating cost and purchasing.

Routings

The next step in manufacture is to prepare routings for each part as called for under 5, Table I (see March 1937 issue, page 10). Each routing shows all operations on a piece, arranged in sequence. The specific types of machines and tools are listed for each operation, together with all operating conditions required for rate setting. Special measuring devices for inspection and manufacturing accessories also are listed by numbers which relate to the part number, operation, and type of tool.

The various operations are governed by the type of equipment already available or to be purchased, and by the fabricated form of the material for the part. There often are several ways in which a part may be made. The most efficient manufacturing method, considering the conditions, should be selected.

The factor leading to the method finally selected is usually one of cost and convenience as to the plant and equipment available. The list of operations and equipment, based on the final manufacturing drawings, as summarized on the routing sheet, serves as a guide in laying out the equipment in order that the flow of material through the plant may be accomplished economically. This design and routing should be as final as humanly possible before material is ordered and production started.

This final form, however, cannot remain final for long. Conditions are ever changing and must be met by

(Continued on page 50)

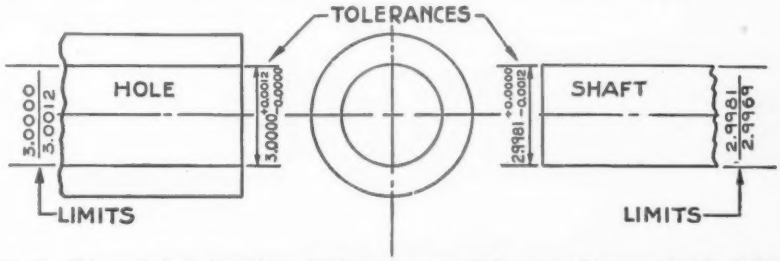


Fig. 3. Hole and shaft dimensions showing tolerances, limits, and allowances for the A.S.A. medium fit, class 3. This fit is used for running fits under 600 r.p.m. and with journal pressure less than 600 pounds per square inch; also for sliding fits and the more accurate machine tool and automotive parts. The tightest fit is with the 3.000-inch hole and the 2.9981-inch shaft, giving 0.0019-inch allowance. The loosest fit is with the 3.0012-inch hole and the 2.9969-inch shaft, giving 0.0043-inch, which is the allowance plus both tolerances.

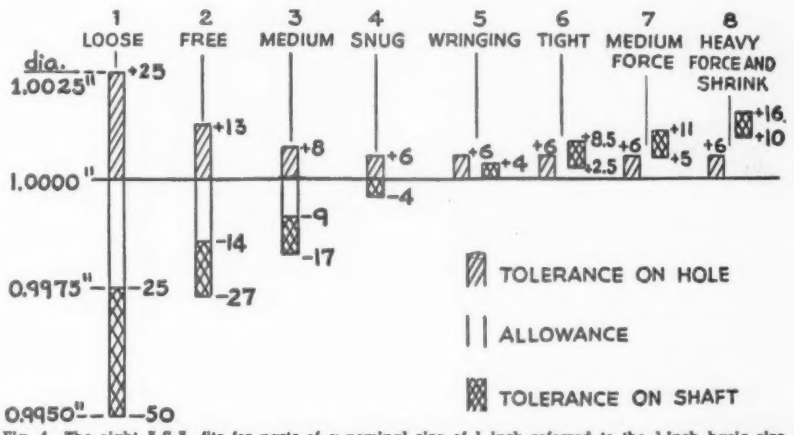
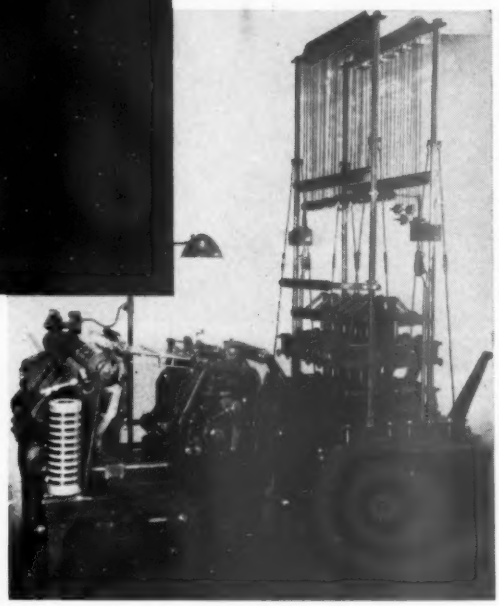


Fig. 4. The eight A.S.A. fits for parts of a nominal size of 1 inch referred to the 1-inch basic size of hole. The basic size of shaft varies with the fit. The values representing tolerances are in 0.0001 inch.

Left—To turn this 32' job it was necessary to increase the capacity of the turntable of this boring mill. The new table was made in four sections, fabricated from H sections and bolted to table. An outboard track was laid on the floor plates to carry the load.

Below—Multiple automatic universal coil winding machine with paper cutting and inserting mechanism, welded construction, automatic turn counter and stop, automatic tension device.



DESIGNING
Special Machine Tools

By O. S. TRUXAL

Mechanical Engineer, Works Department
Westinghouse Electric and Manufacturing Co.,
East Pittsburgh, Pa.

MACHINE tools may be divided into three classes, viz., Standard, Semi-Special, and Special. Standard machines are usually built in large quantities and the cost of development is charged to a number of machines, so that each machine bears only a small percentage of it. Semi-special machines are usually built from standard units, assembled on a special frame or base to suit the particular work they have to perform. The cost of development is higher than standard machines, due to the additional engineering and development required. Special machines are usually designed and built in the plant where they are used, as it is usually possible for the designer to get more information regarding what is really required and can follow the development more closely. Very often process specifications regarding the work to be performed on a special machine are made up after the machine is built, so the design engineer and the process engineer have to work together in order to accomplish results.

Sometimes it happens that the process requires something built into the machine that is either very costly or questionable whether it will operate successfully. By a minor change in the process it may be possible to eliminate the costly or objectionable features in the machine. As each special machine usually presents a problem, or problems, different from any other machine, it is very difficult to lay down a set of hard and fast rules for designing them. There is usually one of two reasons for designing a special machine—either no equipment can be purchased to do what is required or it is being done manually at a higher cost than it could be done on a special machine.

First Steps

Let us consider some of the steps taken in designing a special machine. First: Obtain an approximate total cost of the machine installed ready to operate. This would be very simple if there were detail drawings, but generally no drawings have been made up to this time; and very little money will be spent to make even layout drawings, until the approximate cost is submitted. Second: A work-sheet is made showing the sequence of operations required and the length of time required for each, together with any other information available. Third: From above information a preliminary layout is made which roughly covers the main parts required, but showing few details.

The design engineer then analyzes this layout to see if it is possible to do the operations outlined, and also, to arrive at a fairly accurate conclusion as to the requirements of the drive mechanism and the horsepower required. Up to this time it is readily seen that most of the machine is only imaginary, and the design engineer is the only person who has any idea of what he contemplates building. Therefore, he should estimate the approximate cost. This estimated cost will depend very much on the experience of the designer, also his knowledge of the equipment available for building such a machine. Different departments will have different costing rates which may vary as much as three hundred (300) per cent, so it requires careful analysis of where

(Continued on page 38)

STANDARDS and STANDARDIZATION

By F. O. HOAGLAND

Master Mechanic,
Pratt & Whitney Division, Niles-Bement-Pond Company,
Hartford, Conn.

THERE has already been considerable work done in the line of standardization, and, as your Society in all probability will do its share also, it is well to know what has been done that is pertinent to tool engineering, and what is in the works at present. You will thereby save yourselves considerable time and effort and avoid a great deal of duplication.

The source of this information is the American Standards Association which was established to provide:

(a) "Systematic means by which organizations concerned with standardization work may cooperate in establishing American standards in those fields in which engineering methods apply to the end that duplication of work and the promulgation of conflicting standards may be avoided.

(b) "To serve as a clearing house for information on standardization work in the United States and foreign countries.

(c) "To further the standardization movement as a means of advancing national economy, and to promote a knowledge of, and the use of, approved American industrial and engineering standards, both in the United States and in foreign countries, but not to formulate standards."

It has been my pleasure for several years to represent the National Machine Tool Builders Association on the Council of the American Standards Association and my endeavor will be to show what the American Standards Association is doing.

As you may have noticed, the scope of the American Standards Association is very broad and in order to give more concentrated service to the mechanical industries and societies, the Mechanical Standards Committee was established and its purpose is as follows:

"It shall serve as the general advisory and correlating committee of the ASA in the mechanical field, both in the establishment of American Standards and in international cooperation in standardization work; to consider what subjects are appropriate for development in the ASA; to define and limit the scope of projects; to recommend sponsors; to follow up work in progress in the development of projects; to review the personnel of committees responsible for projects to insure their representative character; to examine recommendations submitted by sectional committees; to harmonize conflicts; and to perform such other functions on behalf of the Standards Council as may be delegated to the MSC."

EDITOR'S NOTE:

In his paper on Standards, Mr. Hoagland obviously omits mention of the American Society of Tool Engineers Standards, since, in the first place, the A.S.T.E. Standards Committee is not yet connected with the American Standards Association, and in the second place, the A.S.T.E. Standards program has been projected on lines definitely pertinent to Tool Engineers. That the works of the various standards associations and committees will eventually converge and supplement each other is self-evident, each group being specifically qualified to deal with problems in its own field.

At date of this publication, the work of the A.S.T.E. Standards Committee has attained considerable volume and momentum, and is filling a definite need for information so far not broached by other standards associations. Mr. Hoagland's paper, however, stresses the interest shown in manufacturing standards and is of particular benefit to our readers. It is almost axiomatic to say that eventually the list of standards will reduce (as, for example, manufacturers of tires have reduced sizes) as differences between various bodies first resolve into agreement, then into subdivision of standards under various and definite headings. There is plenty of work ahead in the establishment of tooling, manufacturing and processing standards.

As there are at least 200 members of the American Society of Mechanical Engineers alone giving considerable time to the various projects of standardization at this time, it is quite essential to have a clearing house for their work so as to coordinate the work and avoid duplication.

Then, there are hundreds of engineers and representatives of other Association Members and Member Bodies of the ASA—such as: American Institute of Mining & Metallurgical Engineers, American Society of Civil Engineers, American Society of Sanitary Engineers, American Society for Testing Material, Society of Automotive Engineers, Institute of Radio Engineers, American Railway Association, Association of American Steel Manufacturers, Electric Light & Power Group, The Underwriters Laboratories, Aluminum Co. of America, Bell Telephone System Laboratories, The War and Navy Departments — covering some 37 Member Bodies, 41 National Organizations, and 13 Associate Members, or a total of 1244 companies entitled to American Standards Association service by individual company membership or through group memberships.

These various technical societies and manufacturers' associations are all interested in technical subjects and are working with standardization in view. It is very noticeable at meetings of representatives of these various groups, how, by cooperation and discussion on problems of mutual interest, progress is being made that would be impossible if there were not a coordinating factory like the American Standards Association.

During 1935, the ASA has approved 33 new standards and revisions, bringing the total of approved American Standards up to 349.

There are many pamphlets of the standards developed under the procedure of the American Standards Association and of particular application to machine tool building, but will enumerate a few only as it would take too long to go through all of them.

First, A Manual of American Standards, which contains a list of all the Standards issued to date.

Drawings and Drafting Room Practice, sponsored by the Society for the Promotion of Engineering Education and the American Society of Mechanical Engineers.

T-Slots, Their Bolts, Nuts, Tongues, and Cutters. This Standard has been found very useful as it gives the required dimensions and has saved us considerable time in the Engineering Department.

Wrench Head Bolts and Nuts and Wrench Openings. We recently had an order for punches for the oblong holes in fish plates for railroad rails. As we had no standard available, and the customer did not give dimensions, we took it up with the American Standards Association, and the desired information was

Presented before the American Society of Tool Engineers, Inc., Bridgeport Section, December 10, 1936.

furnished promptly, although it was found necessary for one of their engineers to visit the private and public libraries in order to obtain the desired information. I bring this out in order to emphasize the service available.

Fire Hose Coupling Screw Thread. This is an important standard from many angles. It has happened that when one city, having a conflagration, was calling upon another city for help they were unable to render any assistance as their hose couplings would not fit the hydrants in the city where the fire was raging, and the results were disastrous. This standard has therefore been made a National American Standard for all connections having nominal inside diameters of 2½", 3", 3½" and 4".

Scheme for the Identification of Piping System: Classification. For example:

	Painted
Pipes for fire protection	Red
Pipes for dangerous fluids	Yellow
Pipes for safe fluids	Green
Pipes for protective fluids	Blue
Pipes for extra valuable fluids	Purple

Preferred Numbers. Why should 12% steps be used for engine lathes, when 25% steps would meet the requirements? At the Pratt & Whitney factory, we have even arranged the amounts of working tolerances we are using on a Preferred Number Series, advancing by 100%; that is, the basic tolerance we are using in the Machine Shop is .001", arranged in geometric progression as follows: .0001(25), .0002(5), .0005, .001, .002, 004, .008, 1/64, 1/32, 1/16, 1/8, 1/4, 1/2, 1.

The amount of tolerance must be selected from this column and no other amounts—like .003, .005 or .007 are permissible.

Exception is made, however, for mountings of ball bearings and roller bearings where the tolerances specified by the makers are used.

By the way, I might mention that the scales we are using in the Machine Shop are graduated in inches and common fractions. We therefore have a memorandum printed on every drawing as follows: "Tolerances of plus and minus 1/64" are permissible when machining dimensions are expressed in common fractions."

This procedure has enabled us to develop a tolerance system approaching closely to 100%.

The department foremen have eventually found it to be of decided assistance to have the tolerances indicated on the drawings and, in a case where the tolerance has been overlooked, he is sure to telephone the Engineering Department and ask for it, before proceeding with the work.

These pamphlets are available in single copies or in a binder, and it is a good way to keep them as, based upon our own experience, it is well worth while to have a set of these for reference in an Engineering Department.

As you have already found out, there is a great deal of work connected with the introduction and maintenance of a system of standardization in a machine tool plant.

In order to obtain the full value of these standards, they must, however, be fitted to your particular requirements, just as a tailor fits you when you buy a ready-made suit. It may not be just as nice as a suit of clothes made to order by a skilled tailor, but it surely will be better than a suit you make yourself and which you are ashamed to wear in public.

It is no use to appoint a committee of superintendents and foremen to take care of this work—they generally meet to smoke and tell stories. You must select a man with engineering and shop experience who can talk the language of the engineers and shop men—who has some ability—and who is tactful in his dealings with the men; and you must train him for his work and give him the assistance he needs in order to keep ahead of the needs of the shop.

The machine designer does not like to be told that there is a standard already established for that particular scheme he had in mind, nor does the foreman in the shop like to be told how much to allow for a running fit in a spindle bearing that he has tinkered with for several years —hasn't he been filing and polishing the spindle bearings after they came from the grinder room, and does he not know that the only safe way is to cut and try?

Ten years ago, 75% of the breakdowns of machine tools was generally due to frozen bearings, that is, improper lubrication. In our own case, it took us a couple of years to bring this down to less than 1%, and we have kept it down there.

In order to cure this source of trouble, it did not mean to look after the oil grooves and channels only; it meant the establishment of allowances for running fits and working tolerances on the shafts and bearings in order to maintain the running fits established.

A particular pamphlet—B 4 A—on "Tolerances, Allowances and Gages for Metal Fits" will meet the requirements of the machine tool builder in a very satisfactory manner. It is based on the Basic Hole System, and tolerances are uni-lateral. That is, holes cannot be smaller than the basic size and the working tolerances are on the plus side only.

In machine tool building, where a great portion of the work is turned on arbors after the work has been chucked, it is very desirable to have the hole large enough to permit the use of a standard arbor. The allowances required in order to obtain a running fit or a driving fit can readily be made on the shaft or the spindle, using the micrometer.

There is, however, a basic shaft system needed for manufacturers using cold rolled shafting to a great extent. In this case, the holes must vary to suit the established standards of cold rolled shafting diameters and this system is not before a special committee under the procedure of the ASA.

Last week, the American Society of Mechanical Engineers had its fifty-seventh annual meeting in New York, and "Standardization" was a very important subject under consideration.

Some years ago, a Sectional Committee was established on "Standardization of Small Tools and Machine Tool Elements," under the procedure of the American Standards Association.

I have before me a report of the status of the work of the various technical sub-committees and it may interest you to learn about some of the projects in process of standardization: Technical Committee No. 1, T-Slots; Eric Oberg, Chairman. Technical Committee No. 2, Tool Posts and Shanks; O. W. Boston, Chairman—and so forth.

In closing, may I suggest that you approach the American Standards Association before taking up new projects of standardization; also, when in need, call upon it for information.

I took the liberty of suggesting to Dr. Agnew, Secretary of the American Standards Association, that a representative of the ASA should attend this meeting, prepared to answer questions that are apt to come up.

PSYCHOLOGY IN INDUSTRY

By
Clayton J. Ettinger

Detroit College of Applied Science
M.D., Ph.D.

"Failure to make provision for the intellectual and emotional needs of self-expression engenders dissatisfaction. . . . Industrial unrest will not cease until the worker is studied as an individual with the purpose of giving him some interest in his work besides the pay envelope."

Monotony

In view of the fact stated that all problems are the result of definite causes, what are some of the outstanding industrial problems, and what factors determine them?

Perhaps the most important problem in connection with the relation of psychology and industry is monotony, or the disagreeable repetition of a unitary impression. Nothing will interfere with efficiency so quickly as those feelings of boredom that usually arise in conjunction with repetitive work. The mechanization of industry, accompanied as it is by an extreme degree of specialization, brings about repetitive work without variation. Minute diversion of work into specialized compartments is now practically universal, and a large variety of these evils are said to have resulted from practice.

Intelligent persons suffer severely when their work is restricted to simply repetitive tasks. A large portion of industrial labor can be performed by morons, hence the demand on the part of some industries for more morons. While repetitive work is distasteful and monotonous to some average or above average in intelligence, to others monotonous work may be desirable. Stereotyped, automatic work can be carried on without much thought. Attention can be therefore diverted to unpleasant ruminations, to day-dreaming, autistic thinking, building air-castles, or planning a campaign of villification against their supposed enemy.

When the mind of the worker is preoccupied with dreams and imaginings, illusions and yearnings, and only a small portion of his energy is given to the work at hand, it is bad for the employer. The worker's feelings toward the work situation are definitely colored by his reveries.

In the monotonous work of industry, which fails to add to the laborer's sense of worth and dignity, the impulses of good workmanship are balked because the work is entirely devoid of interest. When a man enjoys opportunity for initiative, his intellectual powers are aroused. He is interested in his work and eager to show results.

When an impulse is suppressed, there develops fear, restlessness and resentment, which may express itself in unconscious reflex action, or in the intense consciousness of baffled rage or depression. Again, men who are disgruntled because of forced submission to monotonous work often find vent for their resentment in an unreasonable and aggressive attitude in the home, or in alcoholic debauches. Monotony, unending similarity and likeness in experience and labor, makes for the desire to escape drudgery that destroys all individuality and initiative. Failure to make provision for the intellectual and emotional needs of self-expression engenders dissatisfaction with the forms of expression that would ordinarily prove satisfactory. Industrial unrest will not cease until the worker is studied as an individual with the purpose of giving him some interest in his work besides the pay envelope.

Despite the fact that more opportunities for variety in work are essential to the happiness of the average worker, changes in the nature of work are not always accepted with enthusiasm. Many operatives accustomed to uniformity in the methods and conditions of work are reluctant to change to a more varied procedure. This attitude illustrates the inertia produced by long established habit and the wish to live along the lines of least resistance.

While it seems reasonable to infer that change in the type of work must not be too numerous if a high degree of efficiency is desired, there is a certain amount of evidence to show that in repetitive work of a fatiguing nature, changes in the form of activity should be relatively more frequent. In every case, the individuality of the worker must be considered. Of two individuals possessing the same degree of intelligence, one may become tense and bored, while the other, phlegmatic and lacking in imagination, suffers no ill effects. Workers for certain tasks of a repetitive type should be chosen then from the standpoint of personality and interests. Again, it would be advisable that activities be changed more frequently, that rest pauses be instituted, so that workers be permitted a break from monotonous routine, and relief from nervous tension.

Industrial Fatigue

In modern industrial society, a man can no longer set his own pace, because he must keep up with the machine. Others are dependent on his work so that they may add their particular contribution to the sum total of the product. A man who is slow and awkward may make it necessary for an entire assembly line to be geared to his particular rate of work. Not only is this true, but lack of speed and accuracy stand high among the causes of accident.

Speed at which the work is performed is a factor of great importance in causing fatigue. At a certain rate of work or optimal speed for a particular worker, the efficiency of that individual is the greatest. This rate would be the least liable to cause fatigue or accident. Of course, we are speaking here of physical fatigue, which is dependent upon the following factors, all of which have a marked effect on the speed of the worker: adaptation to the job, rest periods, defective ventilation, humidity, excessive noise from ma-

chines, dust, distraction, complexity of the work, bad lighting, poisonous gases, unhygienic conditions, and posture.

In a recent article on fatigue and noise in industry, Dr. Foster Kennedy makes the astounding statement that from sixty to eighty percent of the industrial population have ear trouble, caused by mechanical noise. One authority declares that in some cases total deafness results from prolonged exposure to loud noises. Failure to function because of noise accounts for much of the fatigue felt at the end of the day. While the normal ear has a remarkable tolerance to intense sounds, it is hazardous to go beyond the critical or safety point.

Perhaps the most important type of fatigue is that of mental or nervous origin. Fatigue does not always result from physical activity or external forces. Prolonged mental effort, constant strain, or emotional excitement, can make one just as tired as muscular exertion. Moreover, marked fatigue in one mental function reduces one's ability to perform other mental functions only slightly, so that one may feel exhausted, become inefficient with one type of work, but still be able to turn to another type of activity with a high degree of efficiency. This would seem to indicate that mental fatigue may be caused by factors not inherent in the work itself. What people call "nervous fatigue" or "brain fag" is rarely exhaustion of nerve tissue itself. It is rather a general bodily condition which might be relieved by continuing to exercise the brain and nerves, but in a different kind of activity.

An extreme form of nervous fatigue is that of "neurasthenia" a form of what is called "psychoneuroses." It is from this group in particular that many industrial problems arise. Psychoneurotics comprise the largest single group of employees that the psychiatrist is called upon to treat. No physical or structural lesion can be demonstrated in these nervous conditions. In all cases, there is a narrowing of interests and a fixation of attention upon themselves, with an emotional reaction out of all proportion to their complaints. In other words, these individuals are emotionally immature and act like children. They translate their disappointments into such symptoms as dizziness, pain in the back, headache, constipation, loss of sleep, and a host of other complaints. They are depressed in mood, irritable, gloomy, have no desire to work or do anything useful. They experience difficulty in concentration and therefore cannot keep up active and prolonged work. Such maladjusted workers will frequently attribute all their illnesses to overwork and exhaustion.

Nervous breakdowns are very seldom caused by overwork alone. They are generally the result of prolonged worry and unhappiness. Few people overwork and few realize the joy and happiness of conquest. The structure of normality is built upon joy, happiness and interest; the basis of mental health for the average adult is more work, provided the work is not mere drudgery. The worker who is gainfully employed in interesting work in wholesome surroundings, is generally more or less at peace with himself and is the most efficient worker, quite capable of conducting himself in an effective way with respect to his occupational and social environment.

Efficiency

Reference has frequently been made to the efficiency of the worker. The conception customarily held of an efficient worker is largely determined by the efficiency expert whose primary object is "product." Very often when this expert speaks of his great God, "Efficiency," he means nothing at all. When this term does convey a meaning it is apparently economic and not physical efficiency. The efficiency engineer is usually destitute of social sympathy and he acts in accord with compulsory militaristic procedure. What efficiency generally implies is a division of the output by the input; the quotient is called "efficiency."

When a worker is said to be working efficiently, the efficiency expert usually thinks of nothing but output, for he is not concerned with the energy put into the worker. As regards economic efficiency, the expert does not think in terms of energy transformation at all, but dollar transformation. The input is represented by the worker's wages and overhead charged against him; the output by the increase in the value of the product that the worker creates. Accordingly, if wages and overhead are stationary, the economic efficiency of a worker varies only in relation to his output.

According to Poffenberger, the ideal of human efficiency would be "the production of the maximum output of the highest quality in the shortest time with the least expenditure of energy and with the maximum of satisfaction."

Of course, there is always a best way of going about a task, and it is well to learn this. We may find the best way by learning the proper combinations and rhythms of movements, the time necessary to devote to each, and then build all together to make the whole operation a composite. Proper methods of work are of great significance, since they have a direct relationship to satisfaction and interest.

Accidents

Industrial accidents present economic, mental and physical problems that are of great importance to industry. Fatigue, visual and auditory defects, weather, temperature, time of the day and year, and the age of the worker, are undoubtedly significant in their relationship to the basic causes of numerous mishaps. In the main, however, accidents are attributable to two sources: the management in its program of standardization, forcing all individuals to follow a uniform rate of speed, regardless of individual differences; carelessness, inattention or incompetence of the worker, due to inferior biological equipment, emotional or mental factors.

According to reliable sources, at least eighty-five or ninety percent of all accidents have as their proximate causes the mental conditions of the workers. The majority of accidents are caused by a very small percentage of employees even when the whole group perform the same type of work. It seems evident then that the working situation alone is not responsible for accidents. Workers who have the most accidents are generally found to be the ones who make the most errors in their work, who have the poorer attendance records, and who react more slowly, or more reluctantly to supervision.

Some plants do not proceed further in their accident investigation than to note that the man was inattentive, disobedient, or perhaps careless. While records of this kind are valuable, they do not constitute a thorough analysis of an accident. Rarely is a man's attitude in connection with an accident investigated. If it is found that he was disobedient or inattentive, he is told to improve his behavior. The matter is considered closed even though the employee suffers further accidents from mental causes. The only action

taken by some plants is to protect themselves by dismissing the worker, providing his accidents result in spoiled work. They fail to consider that any worker who has gone through the process of being hired and trained for a job represents a very definite investment for the firm, which investment should be protected. Replacement does not necessarily mean a better man. High labor turnover is an unnecessary expenditure. In reclaiming a worker who would otherwise be lost to an industry, a service is rendered both to society and to the plant that has taken such initiative.

Industrial establishments should constantly keep in mind the mental factors that increase liability to accident. Lack of emotional balance is a frequent cause of defective workmanship and personal injury. A recent survey of industrial mental hygiene by the University of Pittsburgh lists in the order of their importance the following psychological factors: mental deficieny, mental illness, slow reaction time from any cause, lack of power of concentration, awkwardness in performing simple tasks, tendency to worry, or become easy or unduly excited or depressed, poor habits rendering worker less observant at times, or less capable of performing usual tasks.

Among the most important psychiatric diseases which interfere with the worker's efficiency and proneness to injury are: syphilis of the central nervous system, epilepsy, alcoholism, and dementia praecox. These disorders take a large toll from industry. Paretic or syphilitic workers are a menace to their fellow workers, in their forgetfulness and lack of muscular coordination, which leads to accidents and personal injury. The excessive use of alcohol by industrial workers is very marked. Alcohol reduces the worker's mental reliability and muscular coordination. A large group of industrial workers suffer from dementia praecox. Their abstraction due to abnormal thoughts and their forgetfulness make them a serious source of danger. Many accidents occur to workers of this group when they are in a preoccupied and depressed frame of mind.

Recognition of the direct relationship existing between the mentality of the employee and accident has been grossly underestimated. Not only does intelligence have a direct bearing upon liability to injury, but the worker's state of mind in relation to home conditions and illness, is of considerable importance, as well as his attitude to his immediate job supervisor. A type of supervision should be exercised that will give employees a wholesome attitude toward their jobs. Unpleasant physical surroundings tend toward annoyance and fatigue, and these factors in turn produce irritation and unrest, manifested by insubordination, reduced output, spoiled work, disregard of safety rules and accidents. Accidents, moreover, may occur as a defense against the grinding drudgery of monotonous machine work, as a means of evading responsibility and escaping from irksome obligations.

Injury to the worker could be avoided in large measure by the proper selection of men for their jobs, by correct training to meet the various contingencies which might arise in the course of work, and by the adjustment of machines and conditions to meet human needs. Psychological research and scientific handling of the acident problem can do much in a program of prevention which would reduce greatly personal and property losses.

The Need for Psychological Research

It is estimated that about twenty percent of employees in business and industrial organizations are considered "problem" individuals. They are either liabilities or potential liabilities to the employer. In this group are found repeated transfers from job to job, resignations, or lay-offs. In industry they are regarded as production problems, chronic attendance problems, chronic health problems, industrial psychopaths, paranoics and the like.

Not always is the industrial psychopath an employee, for occasionally among the higher officials in a plant are found individuals who are constantly stirring up trouble by their arrogant methods of handling men. Nothing is more calculated to foster ill feeling and resentment than military firmness and autocratic control. Grievances of workmen originate in many cases in their contact with despotic superiors.

In studying the life histories of problem individuals and analyzing their careers, the psychologist and psychiatrist are impressed with these basic outstanding factors commonly underlying work failure: maladjusted personality, specialized job disabilities, and faulty physical conditions. Through proper analysis and placement, such maladjusted individuals can make distinct contributions to industry.

If one speculates upon our mechanistic western civilization, one is impressed with the outstanding progress made in commerce and industry through the invention and scientific discoveries of physicists and chemists. Many large scale industries have their foundations in the experiments of the research laboratories. Great industries that were constructed by engineers on the frame work provided by the physical sciences soon began to rely upon these sciences to furnish guiding principles for further advancement in evolving, selecting, and applying materials and techniques.

For more than a generation the physical sciences have dominated the research activities of our universities. In fact, three-fourths of the endowments for institutions of higher learning went into the support of institutional research. Curiously enough, throughout this period of almost strictly physical progress, only a trifling amount of scientific research has been devoted to problems involving the human factor, as compared with the study that has been given to the design and care of machinery. In general, industry has been so appreciative of the contributions of the physical sciences that it has given little, if any encouragement to the human sciences: economics, sociology, psychology and psychiatry, which are the legs of the tetragon upon which the science of industrial management rests. Without the support of these fundamental sciences, management cannot direct infallibly technical progress. Certainly, industrial research must utilize the human sciences, as well as the physical science, if it is to develop that plasticity so necessary for modern industry in order to cope with the problems of such magnitude as the human personality.

In general, industrial managers continue to view human scientists as "pure" scientists, who have a life apart and distinct from the problems of industry. It is becoming more evident that these managers need to concern themselves less with inanimate objects, and more with extremely vital and active collective behavior. It is infinitely more important to get better men than to get better radios, bath tubs, tooth paste, cigarettes or shaving creams. If our modern radio or electric refrigerator, creations of research, are worth many times their cost, surely

(Continued on page 34)

PRODUCTION PERSPECTIVES

News of Mass Manufacturing from Everywhere

Wage increases, plant construction programs, improved earnings and more aggressive sales promotion activity are among current factors which would indicate a continuance of the **industrial uptrend.** Serious **labor disturbances** have **not** become too **widespread** as yet although **union organizers are busy** and the forces of Capital and Labor have locked horns over several **legislative** bills now pending.

Among the companies announcing wage boosts during late February and early March, in New England were the following: **Landers, Frary & Clark,** New Britain; **American Brass Co.,** Waterbury, Torrington and Ansonia; **Ansonia Mfg. Co., Ansonia Electrical Co.,** and **H. C. Cook Co.,** all of Ansonia; **Waterbury Tool Co.,** Waterbury, and **J. L. Lucas Co.,** Bridgeport. Most of the **increases ranged from 5 to 10 per cent** and supplemented previous boosts.

A **40-hour work week,** with provision of time and one-half for extra time, has been announced by the following Torrington manufacturers: **The Torrington Co., Union Hardware Co., Fitzgerald Mfg. Co., Hendey Machine Co.** and **Turner & Seymour Mfg. Co. . . . International Silver Co.,** Meriden, **plans two large additions** to its plant. Factory H will be expanded by an addition 100 x 400 feet, one story high, **for the metal stamping department, and a four-story addition** will be built **for the plating and finishing department.**

Pratt & Whitney Co. has completed negotiations for **purchase of the old Charter Oak racetrack property** in **West Hartford,** embracing 116 acres, **and eventually will transfer its entire plant from downtown Hartford.**

Harry C. Clow, production manager of the Eagle Lock Co., Terryville, has been **promoted** to purchasing agent, **being succeeded** in the production post **by Rollin Plumb.**

D. B. Bullard, vice-president in charge of the engineering department, The Bullard Company, Henry Bediger, shop foreman and John Bray, vice-president in charge of sales, were honored for long service at an "Old Timers' Night" program recently. Their terms of service are respectively 48, 49 and 50 years.

There is still a **steady demand for qualified men** in the skilled metal trades and the same difficulty in finding qualified men to fill those jobs, **George F. Harding,** superintendent of the State Employment Service, Springfield, Mass., reported in **announcing that there is a definite pickup in all lines of private enterprise this year compared with a year ago.**

Wico Electric Company of West Springfield reports increased production and sales. . . . **James Tierney** has **completed 60 years service as superintendent** of the **H. B. Smith Company** plant in Westfield, Mass.

The erection of a **new factory** at New Bond Street, Worcester, Mass., is contemplated **by the Norton Company.** The new building, to cost about $200,000 will be one story of Aikin transverse monitor architecture, which permits light from overhead. Construction will be of brick and steel, 350 x 120, and work on the project is expected to commence about May. . . . Employes of the **Millers Falls Company,** of Millers Falls, have **received a wage bonus** of **approximately 5 per cent** of their wages for the past two months. **The company plans to continue the bonus system if business conditions permit. . . . Ludger J. Caron,** president of the **Leominster Tool Co.,** Leominster, Mass., **announces plans** for a **new building to double the present floor space** of the plant due to business expansion. . . . **Fred H. Ryther,** the second oldest employe in point of service of the Millers Falls Company, Millers Falls, is **entering his 54th year.** He was foreman for a number of years.

Westinghouse Electric Company, **East Pittsburgh,** "in response to many requests is **sponsoring** a second **"Machine Tool Electrification Forum"** at their plant April 19-22. The forum will discuss "New Methods and Designs for Machine Tool Electrification." . . . **In Cleveland,** Ohio, we hear that the **New Modern Tool Company** now has a plant on Settlement Road, south of Brook Park Road. This property was formerly the factory of the Western Stamping Company. . . . In Detroit, **A. S. T. Eer Gordon J. Burkett** has become **President of** the newly formed **Advance Tool & Die Company,** with offices and plant at 7356 St. Aubin Avenue. Jerome Sullivan, C. J. Bidigare and Wm. S. Grieves are other executives of the company.

Buffalo firms which are now busily engaged in the building of **air conditioning** equipment and parts include **American Radiator, Fedders Manufacturing Company** and **Buffalo Forge Company. American** Radiator is **now building at least twenty new products** for this industry. **Buffalo Forge is** *b***uilding heavy air-conditioning** machinery in greater volume than in some years. . . . **Employment** figures **for Buffalo** show a gain, which is **double that of four years ago,** according to figures compiled by the Buffalo Chamber of Commerce from reports of 140 factories of the Buffalo District. **A $750,000 auto parts factory** is being **built in Buffalo** for the **Trico Products Corporation** at 817 Washington Street. . . . **In Dayton,** the **Frigidaire** Division of General Motors Corporation **is to handle all manufacturing, engineering and allied operations** dealing with the actual manufacturing of Frigidaire refrigeration products. **No personnel changes are involved,** it was said.

The Cleveland district office of **Danly** Machine Specialties Co., **moved** March 27th **to** their new location at **1745 Rockwell Avenue.** In **Milwaukee** the **Harnischfeger** Corporation is **going into mass production of pre-fabricated houses** on a **more extensive scale.** It is planned to produce "panels' which can be grouped or so arranged as to provide a number of variations in general appearance or style of the prefabricated home. The development, as explained by **Richard Binkowski,** manager, really means that the firm is changing over from producing in terms of houses to producing in terms of panels for houses. These panels are standardized, now, into a 40-inch width. The new type home may now be had in two-story style, with air conditioning, screens, and all conveniences. It will be priced—erected at from $5,000 to $7,500. Thirty-six different exterior designs and forty-eight various floor plans will be available.

APRIL CHAPTER MEETINGS

Chapter Meeting Announcements must be received on or before the 20th of preceding month. Omissions are the result of not receiving this information by this date—in time for publication.

CHICAGO

April 12, 1937—Dinner: 6:30 P.M.—$1.00 per plate. Technical Session: 8:00 P.M., Machinery Club—571 W. Washington Blvd.

Speaker: MR. E. F. SMITH, Haynes Stellite Company, Kokomo, Indiana.

Subject: "Haynes Stellite, Its Uses in Manufacturing Operations and Hard Surfacing Operations."

This talk will be followed by an open forum. Samples and exhibits will be shown. This promises to be one of the most interesting subjects of the present season.

Make reservations with Chapter Secretary, W. T. Wilson, 7428 Euclid Avenue, or phone MIdway 9853. Make your reservation EARLY.

CLEVELAND

April 20, 1937—Dinner: 6:30 P.M.—$1.00 per plate. Technical Session at 8:00 P.M. The Colonial Hotel, 523 Prospect Avenue.

Speaker: MR. S. D. FENDLEY, General Electric Company.

Subject: "Electrons at Work."

This lecture will be an exhibit and demonstration on electrons. Mr. Fendley is Industrial Work-Out Specialist and is a graduate of the University of Kentucky.

This will be the first lecture after the installation of the new officers. Make your reservations for dinner with Mr. G. J. Hawkey, Penton Building, telephone Main 0112.

DETROIT

At time of this page going to press no definite information as to the exact time, date or meeting place was available. However, all Detroit area members will be duly advised by mail. The probability is that the regular April meeting will be a joint meeting with the newly formed Toledo Chapter and on the occasion National Officers will be installed.

HARTFORD

Tuesday, March 30, 1937, 8:00 P.M.—Hartford Gas Company Auditorium, Pearl Street, Hartford, Connecticut.

Speaker: MR E. L. GOFF, Superintendent of Spiral Spring Division, Wallace Barnes Company.

Subject: "The Main Spring."

Special:

Splendid Sound-Movie Showing Spring Making.

EXTRA:

Dinner at 6:30 P.M. sharp—City Club, Allyn and Trumbull.

Tickets $1.25.

Phone any officer for reservation: A. H. d'Arcambal, President, c/o Pratt & Whitney Division; Henry I. Moore, Treasurer, c/o Firth-Sterling Steel Co.; F. L. Woodcock, Secretary, 52 Imlay St.

Come and Bring a Friend.

RACINE

April 12, 1937, 6:30 P.M.—Hotel Racine.

Speakers: MR. A. M. JOHNSON, Vice-President and Chief Engineer, Barnes Drill Company, Rockford, Illinois.

MR. RONALD S. WALKER, Sales Manager of Barnes Drill Company, Rockford, Illinois.

Subject: "Hole Finishing."

A discussion of drilling and honing, illustrated with several movie reels, showing machines in action as well as still pictures to exemplify various classes of work. A large number of actual samples will also be on display. Questions from the floor, during the talk and after, will be answered by the speakers.

Make reservations early by calling JAckson 6460 or by writing to the Secretary of Racine Chapter, 1615 N. St. Clair Street, Racine, Wisc.

MILWAUKEE

April 8, 1937—Dinner: 6:30 P.M.—$1.00 per plate—Republican House, Colonial Room.

Speakers: Messrs. J P. BREUER and S. M. RANSOME, Barber-Colman Co., Rockford, Illinois.

Subject: "Hobs"—illustrated with stereopticon slides.

Blackboard discussion: MR. HARRY SEDGEWICK, member A.S.T.E., will conduct the informal blackboard discussion.

Make reservations early.

New Equipment

Brown & Sharpe No. 2 Vertical Spindle Milling Machine (Light Type)

This machine rounds out the Brown & Sharpe line of "Light Type" milling machines, and is designed to handle the ordinary run of work in the average shop or tool room. Ease and quickness of handling of this "Light Type" machine, with no sacrifice of strength and rigidity, so that work within its capacity may be done both efficiently and accurately, are features claimed for it.

The spindle head of this new machine can be set at any angle to 90° each side of vertical in a plane parallel to the table, a scale reading to half-degrees indicating the setting. A lever-operated locking plunger provides for exact vertical re-alignment of the spindle head.

To facilitate set-ups when the head is swiveled, to permit drilling, etc., at any setting, and to make it possible to do step-milling without changing the position of the knee, the spindle is provided with an axial hand movement of 3" in all positions. The aluminum alloy handwheel is easily transferred to its position at either side of the spindle head; and an adjustable dial at the top of the head permits adjustment of the spindle position to .001". The spindle can be clamped anywhere in its axial movement by the lever at the lower front of the head.

These distinctive features of design open up new possibilities for the vertical type of milling machine. For example, surfaces may be milled or holes drilled consecutively at several angles without the use of special fixtures or attachments, and often without relocating the work in the holding device. Again, using Universal Spiral Index Centers, spirals can be milled, the head being set at the angle of spiral.

The two hardened steel stops at the front of the spindle head are attached to the spindle slide and to the head respectively, and are accurately ground on their facing surfaces. These stops enable the use of measuring blocks for high-precision set-ups for depth of cut, etc.; and in addition, where a run of duplicate parts requires machining each piece at several different depths they permit a considerable speeding-up of the job by step-milling, using a set of prepared measuring blocks (one block for each depth of cut) and with the knee clamped in one position.

The following ranges of automatic power feed are provided: Longitudinal, 28"; transverse, 10"; vertical feed of knee, 15". Adjustable dials permit manual adjustments to .001". The design of the column affords a throat distance of 12" throughout the entire length of vertical travel. With the spindle vertical, the greatest distance from end of spindle to top of table is 18"; and with the spindle horizontal, the greatest distance from center of spindle to top of table is 24¾". For further details write Brown & Sharpe Mfg. Co., Providence, R. I.

▼ ▼ ▼

New Six-Inch Belt Surfacer

Designed to handle a wide range of sanding, surfacing, and finishing operations, a new 6" belt surfacer recently marketed by the Delta Manufacturing Company, Milwaukee, has several unique features.

It can be used as either a horizontal or vertical sanding machine. In the vertical position it may be fitted with a tilting table that permits a wide variety of angular shaping and sanding.

Its versatility enables it to be used not only in the finishing of metal parts with aluminous-oxide and silicon-carbide belts, but also in the surfacing and finishing of parts made of Bakelite, Catalin, and other plastics, bone, tile, asbestos, and many other materials.

The machine is completely equipped with self-sealed ball bearings, lubricated at the factory for their entire life. The drums carrying the sanding and finishing belts are designed to eliminate the necessity of rubber coverings which require frequent replacement. A distinguishing feature is the complete enclosure of every part of the belt and drive mechanism, which not only makes the machine conform to safety requirements, but also enables an efficient dust-collecting system to be added to it.

▼ ▼ ▼

"Eklind" Universal High Speed Milling Head

The Universal High Speed Tool Company, 549 Washington Blvd., Chicago, Ill., announce the Model 4H "Eklind" Universal Milling, Drilling, and Boring Head, a companion machine to their Model 2H "Eklind" Universal High Speed Milling Head.

The Model 4H unit, in addition to having the high speeds for efficient end-milling and other features of the Model 2H, has a four-inch vertical feed. The fine precision of the Model 4H makes it suited for spotting, drilling, and boring holes in the layouts of dies and jigs, it is claimed.

The Head is mounted on the overarm of any horizontal milling machine and is motor driven, supplying spindle speeds through a V-belt drive of 250, 400, 700, 1100, 2100, and 4000 RPM by means of a six-stepped cone pulley. This extreme range provides for $\frac{1}{16}$-inch end

mills as well as adjustable boring bars up to 1¼ inches. Collet capacity is ½ inch. The spindle is mounted in double preloaded ball bearings, 12 inches apart, with the driving pulley mounted on its own bearings to eliminate strain on the splined spindle.

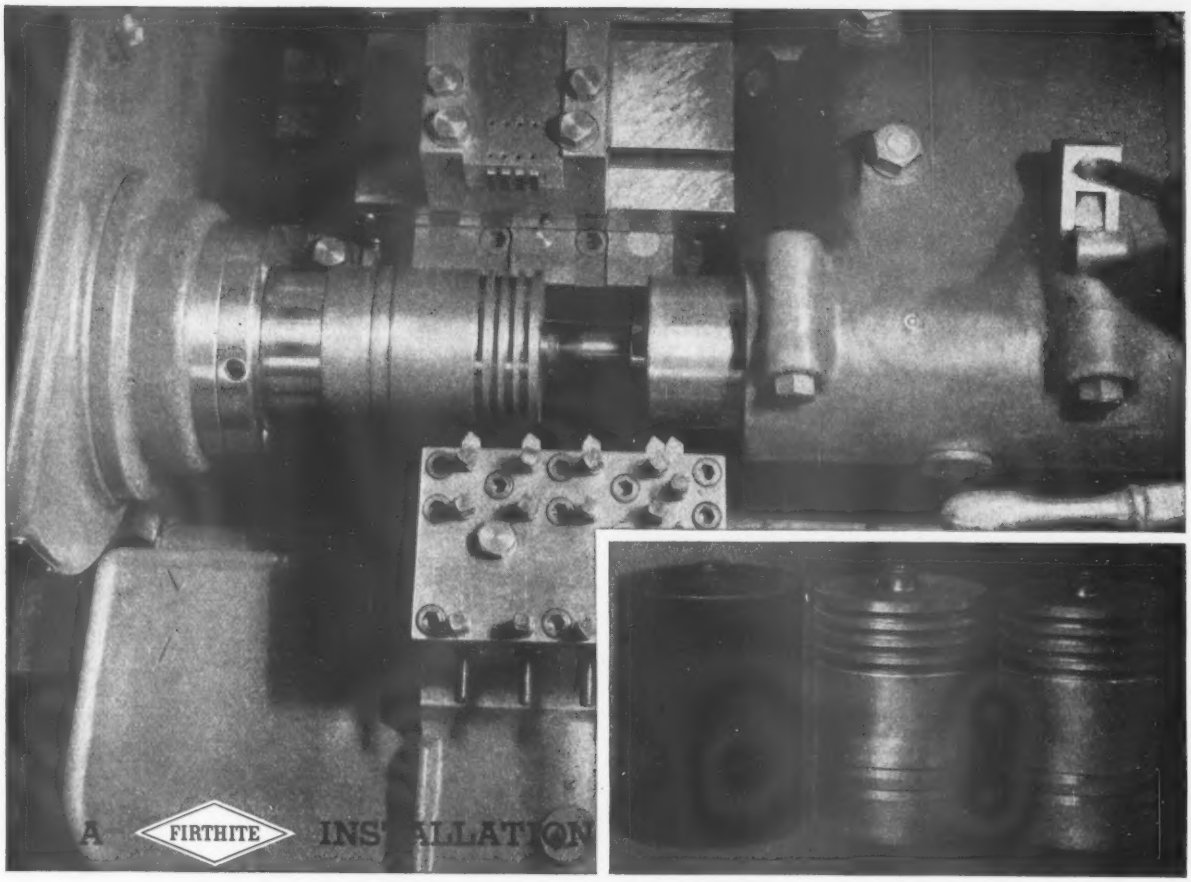
The four-inch vertical travel of the quill is motivated by either a worm feed or lever-operated rack feed. There are double compensating springs counterbalancing the weight of the quill so that sensitivity is obtained.

The depth of quill travel is controlled by an accurate micrometer depth stop which is graduated in thousandths and locked at any point by tightening a collar which acts with pressure radially.

When it is desired to do milling operations the quill is locked by clamping the housing which is split at the lower end. Extreme care has been taken for the quill to insure a perfect working fit with take-up for wear provided.

On many production jobs requiring angular milling or drilling, or both, the Model 4H has proved a highly desirable piece of equipment. For full details write the Universal High Speed Tool Company direct.

(Continued on Page 40)



TWO COMPLETE OPERATIONS—96 SECONDS

FIRTH-STERLING PRODUCTS

Firthite Sintered Carbide Tools
Firthite Sintered Carbide Blanks
Firthaloy Wire Drawing and Extrusion Dies
Circle © Super High Speed Steel
Blue Chip High Speed Steel
Tungsten Hot-Work Steels
Cromovan Triple Die Steel
Invaro Oil-Hardening Steel
C. Y. W. Choice Hot-Work Steel
Special A. S. V. Steel
Firth Winged Ingot Steels
Sterling Stainless Steels
Sterling Nirosta Steels
Globe Drawn and Ground Bars, Drill Rod and Wire
Firth-Sterling Special Tool Steel
Tool and Die Steels for Every Purpose

You cannot afford to overlook **FIRTHITE** on operations like the above. The part is a cast-iron piston, set up in a Sundstrand Automatic lathe. *The first operation*—Rough turning, grooving and facing is completed in ***60 SECONDS.*** *The second operation*—Finish turning and grooving requires only ***36 SECONDS.*** A total floor-to-floor time of 96 seconds for both operations.

FIRTHITE has many advantages on all piston operations, no matter whether cast iron or aluminum alloy, because of its ability to give longer tool life, and greater accuracy. Interchangeability of pistons, as with thousands of other products, is a necessity today. On your own work why not let **FIRTHITE** tools pave the way to more output per machine, longer tool life, and greater accuracy on long or short runs.

Let us tell you more about **FIRTHITE** economies. Literature is available at your request.

FIRTH-STERLING STEEL COMPANY

Works: McKEESPORT, PA.
NEW YORK CHICAGO HARTFORD
CLEVELAND DETROIT LOS ANGELES
PHILADELPHIA DAYTON
GLOBE WIRE DIVISION, McKEESPORT, PA.

HANDY ANDY'S ..WORKSHOP..

My "swan song," in last issue, reminds me of the dying Scotchman who called his pet enemy to his bedside. "Sandy," he said, "I'm gang to dee, an' before I gae awa' I want to make peace with ye. I forgi' ye all transgressions. But noo, Sandy, remember that if I don't dee, then it dinna count." Anyway, I'm back for this issue; only, the nice things I have said about my fellow A.S.T.E.'ers still count.

▼ ▼ ▼

I was over to Chrysler H. P. Plant not so long ago (before the sit-down) as visitor to our Frank Shuler. That man has sure made a fine job of his department, and the more I think about it the more I am puzzled over the enigma of the strike. Why, say, the workers in that plant didn't know the meaning of work (note the past tense), and as for comforts, home had nothing on its conveniences and pleasant conditions. But what I started out to say is that our V. P. is a real go-getter.

▼ ▼ ▼

That "sit-down," by the way, spoiled a darned nice party for our Detroit Chapter; however, we here extend appreciation for good intentions on the part of Chrysler management. Another time, eh?

▼ ▼ ▼

I hear Bert Carpenter's back in town. Say hello to a guy, Bert.

▼ ▼ ▼

You know, I've always said that there is plenty of live material in the A.S.T.E., when it comes to writers and such. That article by John A. Markstrum in the March issue tickled me plenty. Want my job, John? I'll nominate you.

▼ ▼ ▼

Carl Oxford's contribution went over big, too — plenty of "meat" there. The same goes for Larry Terbruggen. Keep 'em rolling, boys.

▼ ▼ ▼

Well, now, we're getting real highbrow in our adolescence (we're five years old now, you know) what with Profs. Boston of the U. of M., Horack of the University of California, and Dr. Ettinger of D.C.A.S. contributing to our columns. Prof. Boston, by the way, is now a bona fide A.S.T.E.'er. Welcome, Professor!

▼ ▼ ▼

You know, this psychology stuff that Dr. Ettinger is putting across is really the coming thing. We have been thinking of machines and mechanical efficiency so long that we've sort of gotten away from the basic principle that man is really the works in this scheme of things, not the machine. For the first time in history man is beginning to study man—and what a field that opens up!

▼ ▼ ▼

Looks as if Otto Winter put Toledo on the A.S.T.E. map. By the time this goes to print we'll have a close neighbor to visit. Good work, Otto! And say, did you ever read that junk I sent you? I haven't time to write you a letter.

▼ ▼ ▼

Got talking with Jimmy Giern the other eve, and through him met his side-kick, Mr. Anholtt. Great team, that pair.

▼ ▼ ▼

By the way, if any of you Milwaukee boys run across Thure Theander tell him his brother Oscar (Detroit) wants to know why in heckelfelt doesn't he join the A.S.T.E. Come in, Thure, it's a great ol' gang.

▼ ▼ ▼

Going from one thing to another, I want to have a serious talk with you boys, not as father to son, but as brother to brother. It's about dues, and frankly, there were plenty of delinquents a while back. I wrote some letters (and that was work, by the way) with pretty fair results, only, I'd like to see it 100%. So would you.

▼ ▼ ▼

Seriously, the A.S.T.E. cannot operate without money, despite that so far every officer and committee worker has given his services, not only gratis, but often at considerable personal expense. But it takes money for office and clerical costs, for mail and traveling expenses, the latter mounting with the phenomenal growth of the Society. And I challenge anyone to show where they can get more honest-to-gosh value for their money, Why, good gosh, men, we've put Tool Engineers on the map! We have resolved a conglomeration into a profession.

▼ ▼ ▼

The plain fact is that the delinquencies are mostly the result of carelessness, of procrastination. You meant to remit long ago, but you just put it off. But now, reach for the check book and fountain pen, or amble over to the corner for a money order—anything!—as long as you do it now. Gosh, how do you suppose we put out Standard Sheets, or plan meetings and the thousand and one activities of the Society? By waiting until tomorrow? Hell, no!

▼ ▼ ▼

The meeting of the A.S.T.E. Board of Directors held March 19th at National Headquarters in Detroit was, in my opinion a milestone in the history of A.S.T.E. Many plans for definite action were laid and decided upon—these will be fully covered in the next issue of "The Tool Engineer" — including the election of the National Officers.

▼ ▼ ▼

I wish you all could sit in on these Board Meetings of A.S.T.E. (You can, you know—as these meetings are at all times open to the membership, of course). It would be an education to most members to see and hear the deliberations of this body. Believe me, these men really weigh questions—hearing both sides. Frequently the issue becomes so crystallized or clear cut that the vote is then unanimous.

▼ ▼ ▼

What particularly bothers me is that a number of my personal friends are among the delinquents (I have friends, but darn 'em, they pile a lot of work on me) and I'm looking for them to stay put. Those of them who aren't my friends are someone else's, and they feel the same way about it.

▼ ▼ ▼

Would some Power the giftie gi' me—to be a diplomat or a politician. But regardless of my line of attack it's all in good fellowship and there's a smile behind every word. People who know me will tell you that, and now, don't let me down.

▼ ▼ ▼

Some day, I'm going to tell the boys in Hartford what happened one night at the corner of Farmington Avenue and Flower Street. Oh, I've been around!

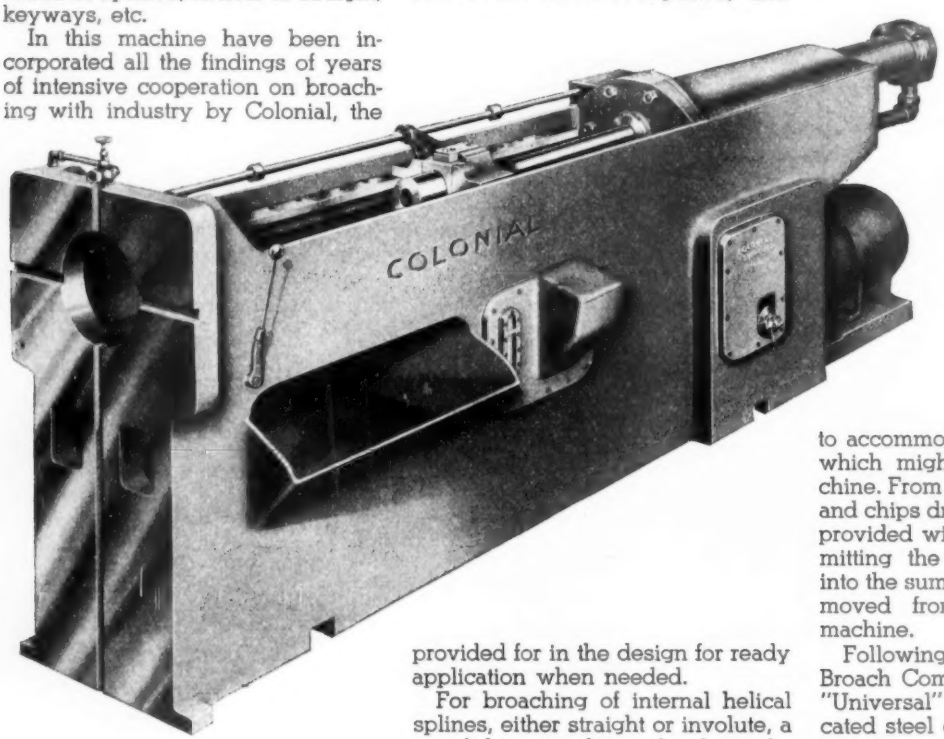
Handy Andy.

THIS MONTH'S COVER

What is probably the most modern all-purpose broaching machine yet developed, has just been announced by Colonial Broach Company, Detroit. Designated as "The Universal" Broaching Machine, it represents a happy combination of utmost flexibility and adaptability together with high production speed and automatic operation.

Designed for pull type broaching and hydraulically operated, it is as readily adapted to surface broaching as to the broaching of holes, round or splined, helical or straight, keyways, etc.

In this machine have been incorporated all the findings of years of intensive cooperation on broaching with industry by Colonial, the world's largest broach manufacturer. Available in two basic stroke designations—48 and 60 in.—the machine comes in four tonnage capacities: 6, 10, 15, and 20 tons.



The New "UNIVERSAL" Broaching Machine Announced by COLONIAL.

Stop collars are provided on the machines so that any requirement as to stroke length can be met, in accordance with the work to be done and the broach being used—assuring maximum production capacity.

Standard cutting speed is 30 ft. per minute. But again, a conveniently placed control permits adjusting of cutting speed to any speed up to this figure that may be desired. Return speeds of either 60 or 100 ft. per minute are optional and are controlled by a differential area design in the operating cylinder.

For surface broaching, the unusually large face plate capacity, with its two keyways for ease and accuracy of location of even extremely large surface broaching fixtures, is noteworthy. Tools up to 9 in. in width or even slightly larger, may be used with this machine.

The need for follow rests for the handling of very large broaches of course has been recognized, and provided for in the design for ready application when needed.

For broaching of internal helical splines, either straight or involute, a spiral drive attachment has been developed for this machine. It consists of a rigidly mounted spiral master bar which, through gears, causes the broach to rotate as it passes through the work, producing the correct helical lead in the finished part with greater accuracy, eliminating side thrust and drag on the sides of the splines, and increasing broach life. All machines are furnished with mounting pads for this attachment.

The machine may be operated from either the right or left sides, dual controls being provided.

A complete range of broach pullers is available with the new "Universal." Included are the recommended automatic pullers designed for maximum accuracy in maintaining alignment and proper broach locating; also threaded pullers for the broaching of keyways, if desired; and key-type pullers where maximum simplicity and low cost are desired. Puller adjustment is simplified by the provision of locating markers on the cross-head and pull-head.

Chip removal presents no problem with this machine. Furnished with every machine as standard equipment is a chip trough designed to accommodate the longest broach which might be used on the machine. From this trough all drippings and chips drain back into a chip pan provided with perforated trays, permitting the coolant to drain back into the sump and the chips to be removed from either side of the machine.

Following accepted Colonial Broach Company practice, the new "Universal" has a base of fabricated steel designated to absorb all broaching stresses without distortion. Crossheads are provided with easily replaceable hard bronze shoes which travel on hardened and ground ways for maximum life.

The hydraulic power mechanism consists of an enclosed, externally located (for accessibility) electric motor direct-coupled to a 1,000-lb. hydraulic pump.

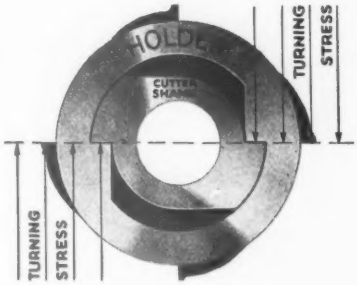
Coolant pumps are of extra generous capacity. Coolant flow starts and stops with the machine for maximum ease of work handling. A bulletin (No. 100-8A) describing the new "Universal" is available on request from Colonial Broach Company, Detroit or through this publication.

SUPER RADIAL DRIVE

Fundamentally and scientifically correct in design and construction, withstanding maximum shocks, strains and torque.

After years of experimenting and developing the Eclipse Double Radial Drive was first introduced at the beginning of the "Return to Prosperity." Its immediate acceptance and adoption since by the larger manufacturers is their endorsement of its superior performance and cost-reducing capabilities.

Recommended for machining operations involving heavy duty counterboring, spotfacing, countersinking, multi-diameter - boring and core-drilling.



Section thru drive showing integral lugs of holder contacting integral lugs of cutter shank on line of center.

FEATURES:

Drive located closest to cutting edge.

All driving and driven surfaces are machined from the solid.

No chatter, no jarring loose.

Simple, Rigid, Modern, Dependable, Economical.

Write for detailed information. Factory representatives in all industrial centers.

ECLIPSE COUNTERBORE COMPANY
DETROIT 7410-30 ST. AUBIN AVE MICHIGAN

TRY-OUTS

"Our friend, Will Rogers, used to have a lot of fun out of the automobile. I remember hearing him tell about being in Detroit when you first started marking off the safety zones. And he said, 'I was up in Detroit last week,' chewing gum, 'and they have the streets all marked off with white paint for the safety zones and if you get hit by an auto while you are inside of those zones, it don't count. It has gotten so now the only way to be safe is to keep a pot of white paint and a brush in your pocket and when you see something bearing down upon you just paint a white circle around yourself.' Will Rogers also told about his first airplane ride with General Mitchell. They flew around the Washington Monument and Will was scared and when they came down he said, 'If that thing would have had handles on it he would have lost a door and that eliminated the tails. Then one man stood up on his hind legs and discovered alcohol and second mortgages and high blood pressure and other advantages of civilization and started a lot of trouble for himself.

"One business man met another on the street and said, 'We are having a terrible time keeping the wolf from the door.' And the other man said, 'The wolf has come right into our house and had pups.'

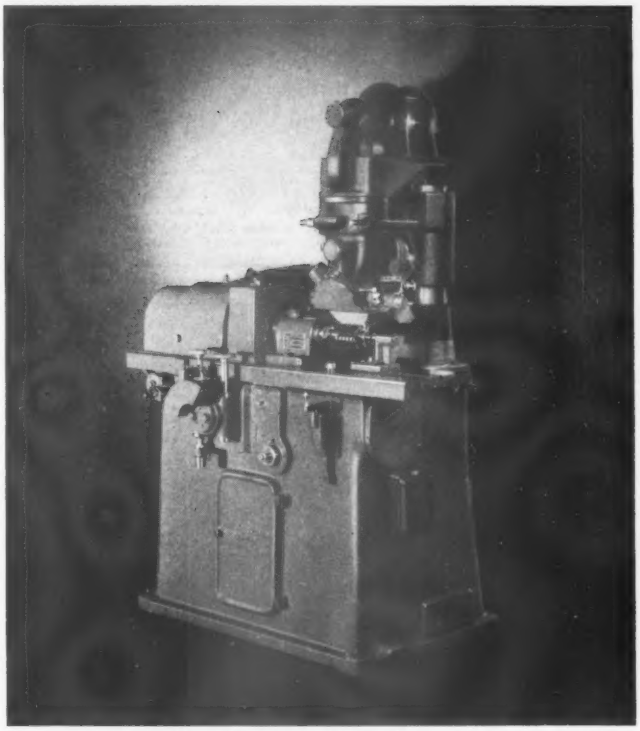
"We have a lot of self-confessed saviors of the country. First of all we had the Technocrats. I will bet you nearly forgot them. There are too many machines and you have passenger.' Later he was on a flight with Colonel Lindberg and just as they flew over San Diego a terrific wind came up but Lindberg made a perfect three-point landing into the wind. And Will said, 'How did you know which way the wind was blowing?' And Lindberg said, 'Didn't you see those clothes on the line back there? I could tell by the way the clothes were blowing.' And Will said, 'But what would you have done if it wasn't Monday? What would you have done if there hadn't been any clothes on the line?' And Lindberg said, 'Will, I wouldn't fly over such a dirty town as that.' . . . Of course, the evolutionists say it is all a matter of evolution. Our remote ancestors used to wear tails and then they invented the revolving been too busy and upset over business changes and changes in fashion and custom. For example take the matter of women's dress. It used to take two sheep one year to clothe one woman. Now one silk worm can do it on his Saturday afternoon off. That throws the sheep out of a job. And speaking of sheep, an old grandpa and grandma were sitting reading the paper and grandpa said, 'It says in the paper that over in Australia they cross the sheep with the kangaroo and they get a mighty fast product. The lambs can run eighty-five miles an hour, that doesn't sound reasonable.' And grandma said, 'The lambs would have to run eighty-five miles an hour to keep up with Mary.'

"Then we had Hughie Long and his Share the Wealth Plan, and Upton Sinclair and his Epic Plan, and Townsend who proposed the idea that we all go back home and live with grandpa and grandma. Townsend really reminds me of Mark

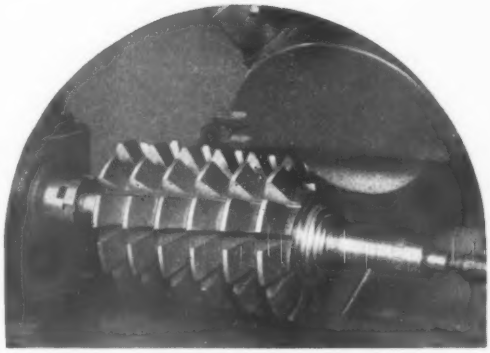
(Continued on Page 34)

THE CHOICE OF EXPERTS

•Sharpens at Least 75% of All Hobs Made in this Country



● No. 3 Barber-Colman Hob Sharpening Machine



Sharpening a spiral gashed hob on a No. 4 Barber-Colman Hob Sharpening Machine.

Who knows better how to sharpen hobs than those who live by making hobs? Who knows better what hob sharpening machine to choose? One after another, hob manufacturers made their choice and today at least 75% of all hobs made in this country are sharpened on Barber-Colman Hob Sharpening Machines before delivery to the purchaser. The machine selected by experts to create the cutting edges on new hobs will serve equally well to renew those edges when that is required. Investigate. Let a Barber-Colman representative analyze your hob sharpening and estimate the savings which can be obtained by the use of a Barber-Colman Hob Sharpening Machine.

Barber-Colman Hob Sharpening Machines are made in two sizes: No. 3 for hobs up to 4″ by 4″, and No. 4 for hobs up to 12″ by 12″ having straight gashes or those having spiral gash angles of 25° or less. Both machines are equally effective for sharpening formed milling cutters. B-C Hob Sharpening Machines are set up easily and quickly, then run automatically while the operator does other work. Automatic indexing is governed by accurately ground plates, no fingers or guides required. It is estimated that time savings up to 75% over other methods of sharpening are obtained. Write us today for all details or a demonstration.

BARBER B-C COLMAN

PRODUCTS

MILLING CUTTERS, HOBS, HOBBING MACHINES, HOB SHARPENING MACHINES, REAMERS, REAMER SHARPENING MACHINES, SPECIAL TOOLS

BARBER-COLMAN COMPANY

General Offices and Plant ROCKFORD, ILLINOIS, U. S. A.

Represented in the Detroit Territory by HODGES MACHINERY CO., 544 New Center Building

A.S.T.E. Chapter News

CHICAGO

Raymond Weeks, Chapter Publicity Chairman, 818 Junior Terrace, Chicago

The following shows the results of the election of Chicago Chapter officers to serve through the coming year and also those elected to serve on the nominating committee. These elections were held at our March 8th, 1937 meeting.

Chapter Officers

Franklin W. Creager, Chairman
Chicago Screw Co., 1026 S. Homan Avenue

Willard T. Wilson, Secretary
Chicago Screw Co., 1026 S. Homan Avenue

Edward F. Bachner, Treasurer
Chicago Molded Prod., 2145 Walnut St.

Nominating Committee

Robert O. Hein—Sears, Roebuck Co., 2243 Lincoln Avenue

Julian C. Kazimier—Chicago Molded Prod., 5543 Cornelia Avenue

CLEVELAND

P. F Rossbach, Chapter Publicity Chairman, 898 E. 131st Street, Cleveland

The March 16th meeting was very well attended. The following officers were elected for 1937

Paul F. Zerkle, Chairman
C. V. Briner, Secretary
A. R. Black, Treasurer

All members wish these men the best of luck and a successful term of office.

Another Tango Party is being planned for the near future. Members will be notified when and where this party will be held.

MILWAUKEE

Emmor E. Houston, Chapter Publicity Chairman, 1029 So. 35th St., Milwaukee, Wisconsin

The Milwaukee Chapter held its annual election of officers on March 11, 1937, at their monthly meeting held in the Republican House.

The nominating committee—Messrs. Rutzen and Radermacher, presented the names of the present officers to succeed themselves. The Chapter unanimously re-elected the following officers to retain their positions for the coming year: George A. Smart, Tool Design Supervisor, Allis-Chalmers Mfg. Co., Chairman; Arthur Johnson, Tool Supervisor, Cutler Hammer Co., Treasurer; Julius Riedl, Tool Supervisor, Seaman Body Corp., Secretary. E. A. Rutzen was elected Assistant to the Chairman.

The officers expressed to the Chapter that although being an officer required a good deal of time, it is gratifying to them to realize the

(Continued on Page 36)

No. 56 Drilling and Centering Machine A Good Investment, Well Protected

How would you face, counterbore, and chamfer the cast iron parts shown in Fig. 1 on both ends simultaneously at the rate of 250 or more an hour? How would you do this at minimum cost on a standard machine that can be applied readily to other operations? Sundstrand Engineered Production answered these questions by equipping a Sundstrand No. 56 Drilling and Centering Machine with two special combination cutting tools and an automatic self-centering fixture having magazine feed. Otherwise the machine, see Fig. 2, is standard throughout including the power feed head which provides the automatic cycle of rapid approach of tools to work, feed, dwell, and quick return. Capital investment is low and well protected because the machine can be applied to a wide variety of other operations at any time merely by supplying suitable tools and work-holding devices. Operating cost is extremely low because the simple, reliable magazine feed, air operated self-centering fixture, and automatic cycle do all the work except filling the magazine, a job anyone can handle easily. Accurate control of spindle movement holds overall length of finished work-pieces well within required limits. Sundstrand Engineered Production experience insures automatic locating of the rough castings accurately in two directions, provides automatic stop for machine if an off-size work-piece clogs the magazine.

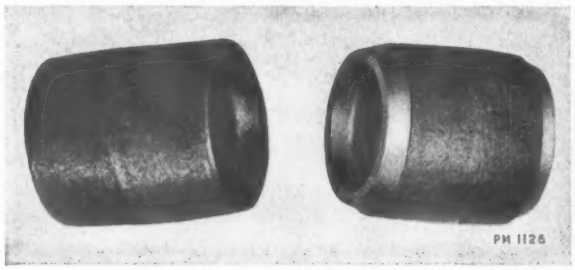


Fig. 1 — Showing cast-iron work-piece before and after automatic facing, counterboring, and chamfering.

Sundstrand engineers have solved many other perplexing production problems by developing applications of No. 56 Drilling and Centering Machines, Rigidmils, Electromils and Automatic Stub Lathes. They will supply reliable suggestions for you promptly on receipt of complete data.

SUNDSTRAND MACHINE TOOL CO.
2532 Eleventh Street, ROCKFORD, ILLINOIS, U. S. A.

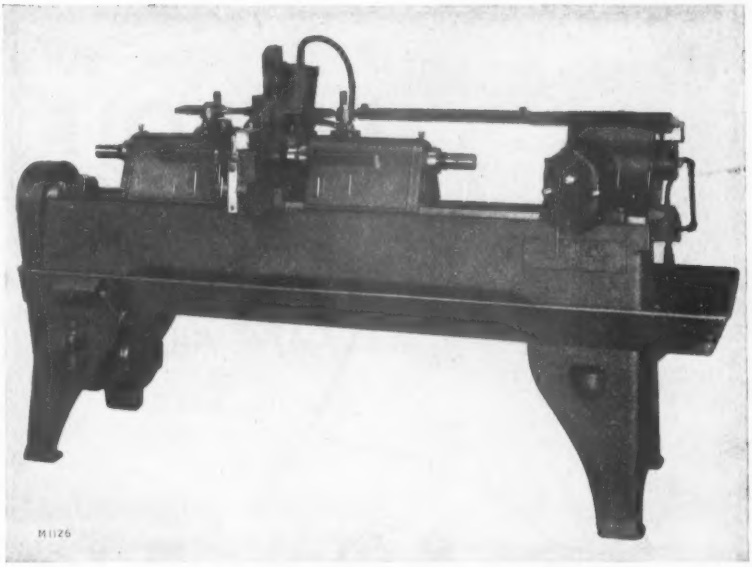


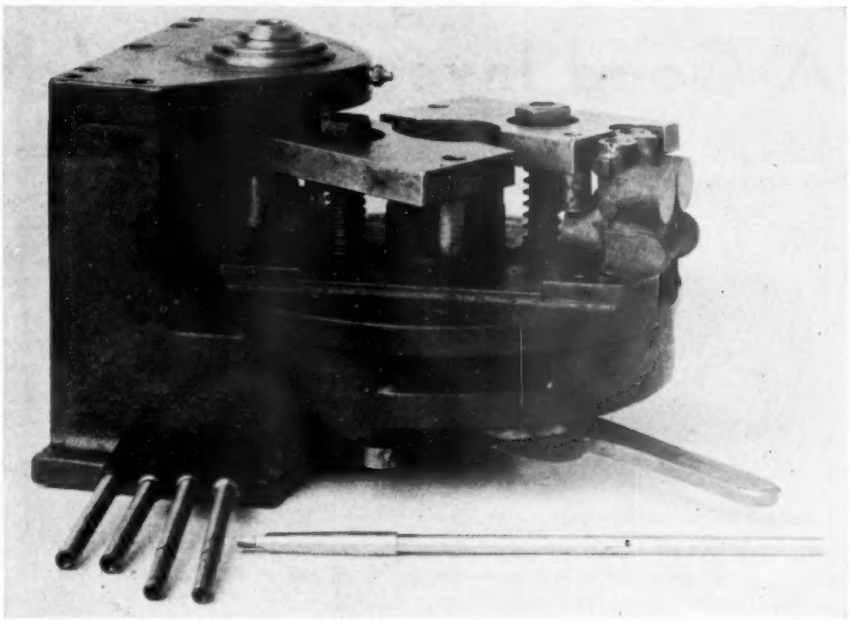
Fig. 2 — Sundstrand No. 56 Drilling and Centering Machine with standard automatic cycle unit and special pneumatic magazine fixture.

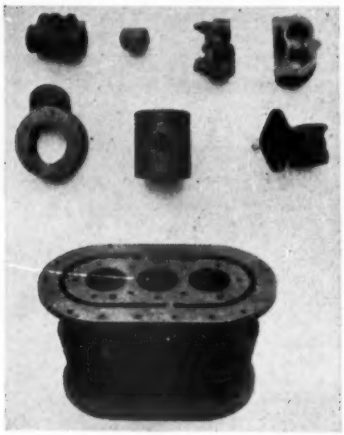
"CARBIDE BORING"
IN A
DRILL PRESS

In a boring fixture with GATCO Rotating Guide Bushings and GATCO Adjustable Tungsten Carbide Boring Tool - Plus a Drill Press - - - you have "DIAMOND BORING"

Right: Typical "Carbide-boring" fixture for small cylinders. One loading station, one boring station.

Below: Typical parts "Carbidebored" with GATCO Equipment.





BUILDERS OF

DETROIT UNIVERSAL DUPLICATOR

GATCO Adjustable Boring Bar

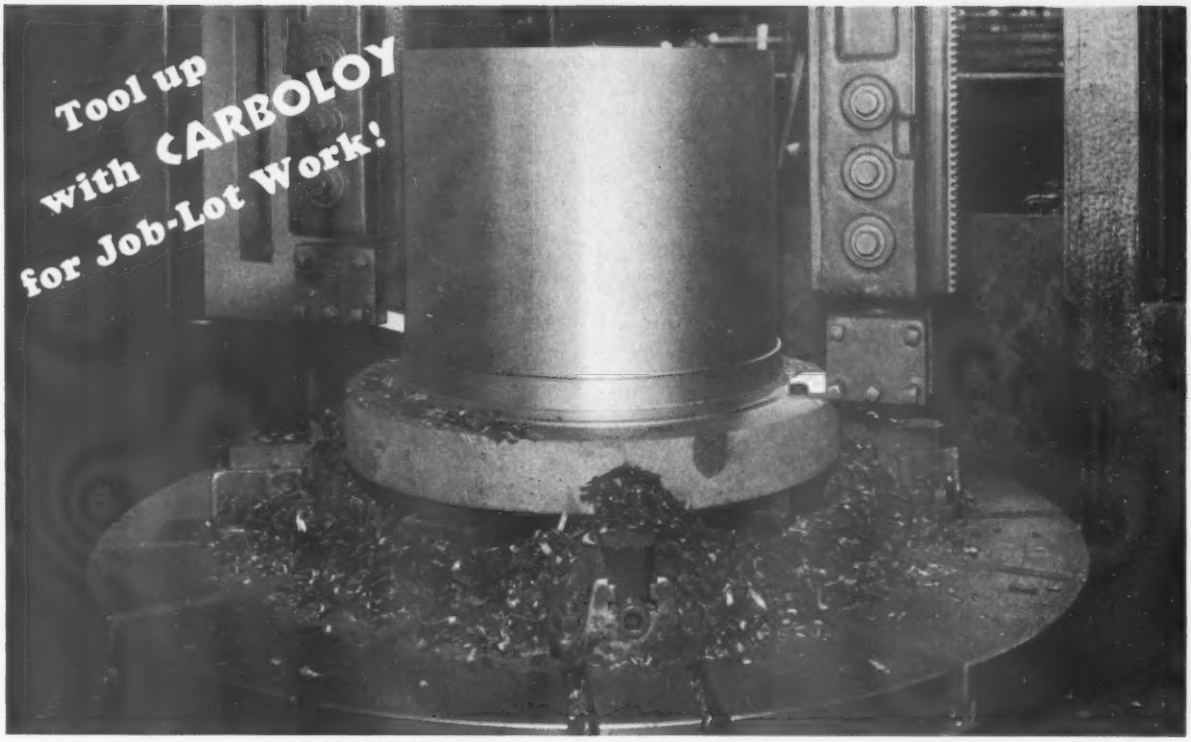
GATCO Rotating Guide Bushing

•

Giern & Anholtt Tool Company

1312 Mt. Elliott Street **DETROIT, MICHIGAN**

P. S. Would you like a set of our new Data Sheets ?



Get *Production Savings* on *Job-Lot Work* On Your Boring Mills and V.T.L.s . . .

Speed up your boring mills and V.T.L.s . . . tool up with Carboloy . . . and get production savings on job-lot work!

With Carboloy standard tools in your crib you are prepared for all general machining operations on cast iron, non-ferrous metals and non-metallic materials. Carboloy standard tools are general purpose tools . . . tools designed to give you the benefits of production savings on job-lot work!

Put Carboloy on your boring mills and V.T.L.s . . . get Carboloy savings through higher speeds, longer tool life, better finish and greater accuracy. Then, when the job is finished, put these *same* tools to work on your engine and turret lathes. Use these general purpose tools *generally* throughout your shop!

Catalog M-32-R—giving specifications of Carboloy general purpose standard tools—sent upon request.

CARBOLOY COMPANY, INC.
2983 E. Jefferson Avenue, Detroit
CHICAGO—CLEVELAND—NEWARK—PITTSBURGH—PHILADELPHIA
Canadian Distributor: Canadian General Electric Company, Ltd., Toronto, Ontario

CARBOLOY REG. U.S. PAT. OFF. **CEMENTED CARBIDES**

New Literature

"Lessons in Arc Welding," published by the Lincoln Electric Company, Cleveland, Ohio, to provide arc welding operators and other interested individuals a thorough working knowledge of the practical application and use of arc welding, has been reissued in considerably enlarged form. The volume, profusely illustrated by sketches, now contains 44 lessons and approximately 130 pages.

The lessons are based on the course in arc welding which has been conducted by the company in its plant Welding School for nearly 20 years and are the result of experience in teaching thousands of men to become practical arc welding operators. They cover: the arc welding machine, its operation and control; the shielded arc and its uses; striking the arc and running horizontal bead; running a bead not less than 12 inches long; weaving the electrode; effect of arc length, current, and speed on bead; effect of polarity on bead; various types of electrodes; padding and building up plates; building up shafts, butt welds; lap welds; tee welds; vertical welds; horizontal welds; overhead welding; expansion and contraction; penetration and cutting; welding of mild steel, light gauge steel, high tensile steels, cast iron, stainless steels, hard facing various metals to resist shock, abrasion, and corrosion; welding aluminum, bronze, brass, copper, and 4-6 chrome steels.

Copies are mailed, postpaid, to any address in the United States for 50 cents each, 75 cents elsewhere. Address the Lincoln Electric Company, Cleveland, Ohio.

▼ ▼ ▼

Holo-Krome New Catalog. Containing tables, data, Standards, illustrations and interesting news for the users of Holo-Krome "Fibro Forged" Socket Screws. Size 8½ x 10⅝ inches. Thirty-eight pages printed in two colors. Sturdy cover. Write theHolo-Krome Screw Corporation, Hartford, Connecticut.

"Gear Problems and IXL Speed Reducers"—Catalog No. 204-A recently issued by the Foote Brothers Gear & Machine Corporation, 5305 So. Western Boulevard, Chicago, Illinois. This large catalog of nearly seven hundred pages will be sent to responsible manufacturing executives, who make request on their firm's stationery.

▼ ▼ ▼

How to Weld 29 Metals. A comprehensive book, covering the procedure, conditions, and materials for welding modern alloys, has recently been published by the Westinghouse Electric and Manufacturing Company. Specific data for welding all types of joints with varying thicknesses of metal, such as electrode diameter, welding current, speeds, deposition, etc., are included. Prepared by Charles H. Jennings, whose experience and exhaustive investigation into the joining of metals have eminently qualified him as an authority on the subject, this book should be of great value to welding operators in simplifying and improving the welding of present-day metals and alloys. Copies of the book are available at 50 cents each from any Westinghouse Welding distributor or direct to department 5-N, Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pennsylvania.

▼ ▼ ▼

The Training School, issued by the Cincinnati Milling Machine and Cincinnati Grinders, Inc. An attractive brochure of 31 pages describing apprentice training in the company's training school. Profusely illustrated and descriptive of method, system of training, etc. Requests for this

(Continued on Page 34)

Try-Outs

(Continued on Page 26)

Twain who said the inhabitants of a town in Italy make a precarious living by taking in one another's washing. I have this Townsend Plan all worked out. I have done it by New Deal arithmetic so I know it is right. The only thing that bothers the Townsend folks is where they are going to get the money and I have that solved. Now, by conservative estimate there would be one hundred thousand rainbows in the United States during the course of a year. I would hire the R.F.C., the Rainbow Finding Corporation to go out and find these rainbows. Then I would have the S.A.P.S., the Shovel and Pick Squad, go out and bring the gold in. Then the P.W.A., Pot Weighing Authority, to weigh the gold. And I have it all worked out by New Deal arithmetic."

Quoted from an address by Chas. M. Newcomb, Detroit, A.S.T.E. meeting.

New Literature

(Continued from Page 32)

booklet should be sent direct to the company in Cincinnati, Ohio, on your firm's letterhead.

▼ ▼ ▼

Hannifin Manufacturing Company —Bulletin No. 40. This new piece of literature describes special hydraulic presses. Twenty-two pages of descriptions and illustrations of various special types of Hannifin presses—many individually designed to simplify the operations required and to increase production. For copies write to the Hannifin Manufacturing Company, 621 South Kolmar Avenue, Chicago, Illinois.

Psychology in Industry

(Continued from Page 17)

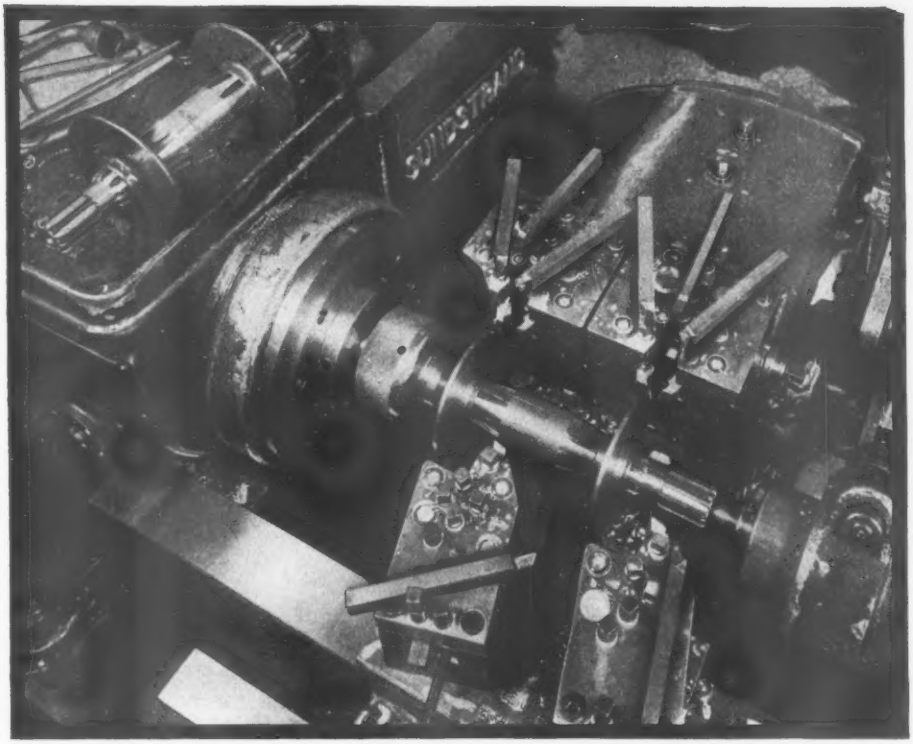
no cost should be deemed too high for the applications of psychological and psychiatric research in industrial management in a human relations laboratory. It seems almost childish to comment on the value to an industrial organization of stability in its working force. The stabilization of industry will come about only through the broad application and adequate utilization of the human sciences.

Just what will psychological research do? Psychologists have already proved that their science can assist personnel managers to select the right persons for many kinds of jobs. The results of their investigations have either immediately or indirectly promoted efficiency and increased production of workmen, improved their physical and mental health, and produced improvements in their morale, in their incentives and in their happiness. Psychological research covers all phases of personnel selection, vocational guidance, the training of the worker, the adjustment of working conditions and environment, and the development of leadership. The psychological method involves an objective and quantitative evaluation. The method pursued is the universal one that science employs in collecting and interpreting facts. The very essence of psychological inquiry is opposed to captious attitudes or preconceived ideas as to findings and recommendations. Investigation is undertaken from the standpoint of completeness and accuracy, and accordingly it requires field study and the gathering of pertinent data, followed by reliable and unbiased analysis of such information.

Consequently, a sound and adequate view of human nature in its relation to industry must take into account all the facts concerning the individual. The avenues of approach to the study of industrial relations involves an analysis of behavior reactions, mental attitudes, intellectual and emotional endowments, physical development, habits, predilections, idiosyncracies, and many intimate and personal details of the daily activities of the man, both in his occupational and social environment. In other words, the study cannot be confined to one aspect alone, but must embrace the problem in its entirety.

In conclusion, industrial experience represents only a portion of

(Continued from Page 36)



Vascoloy-Ramet tools, Grade E, used simultaneously in this operation are:

Rear Block—Style 6 (⅜"x¾") straddle face tool

Style 3 (½"x¾") straddle face tool

4° back slope, 30° end cutting angle

8° and 15° front clearance, 8° side clearance

.030" radius

Style 14 (⅜"x¾") for turning O.D. flange

Front Block—Style 3, same as above

In the illustration, extra tools of the shapes used, are shown on the tool posts.

Machining Forged Clutch Hub, Material—S.A.E. 1035, Brinnell 190 average. Operation—Rear Block, straddle face flange, turn O.D. flange, size hub diameter. Front Block, size hub and fillet radius. Speed 265 R.P.M.—310 ft. on 4⅞" diameter—123 ft. on 1 23/32" diameter. Performance of Vascoloy-Ramet tools:

Vascoloy-Ramet	Feed	Cut	Number of Grinds	Pieces per Grind
Grade E	.007"	1/16"	40	500 to 525

Another production record!

Vascoloy-Ramet, the tantalum carbide hard alloy, is available in 17 grades which cover the entire range of machinable materials. No other tool material covers as wide a range, or with as many grades.

Unrivalled in the machining of all steels from the softest to the hardest alloys, Vascoloy-Ramet alone will turn steel without "cratering."

On cast iron, semi-steel and non-ferrous materials its performance is exceptional.

Whatever your machining problems, one of Vascoloy-Ramet's 17 grades will precisely fit the need, providing more pieces per grind, greater speed from floor to floor, lowered machining costs.

The new Vascoloy-Ramet catalogue, containing revised prices announced October first, is now available upon request to the company or any of its District Sales Offices listed below:

VANADIUM-ALLOYS STEEL CO.
VASCOLOY-RAMET DIVISION, NORTH CHICAGO, ILL.

VASCOLOY-RAMET

. . . The TANTALUM CARBIDE TOOL MATERIAL . . .

A GRADE FOR EVERY USE

District Sales Offices:

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New York	N. Y.
Springfield	Mass.
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Buffalo	N. Y.
Philadelphia	Pa.
Newark	N. J.
Knoxville	Tenn.
Los Angeles	Calif.
San Francisco	Calif.

Psychology in Industry

(Continued from Page 34)

the worker's life and what experiences take place in his place of employment will influence the family and the home. Happy experiences in either environment make for satisfaction and contentment in the other. By the same token, symptoms of personality defects and neuroses are revealed in behavior at work as well as in other activities and in social relationships. From this point of view, it is only when we have investigated the total situation of the worker that we can have the knowledge necessary for the proper evaluation and comprehension of so intricate a problem as human nature or psychology industry.

(Conclusion)

A.S.T.E. Chapter News

(Continued from Page 28)

remarkable success the Milwaukee Chapter has enjoyed in the past year.

After the election of officers Chairman Smart called on C. W. Beckwith, of the Koehring Co., and President of the Milwaukee Club of Metal Trades Association. Mr. Beckwith was amazed that the Milwaukee Chapter does not have a membership committee, and yet has so many members on its roster. He was immediately informed by the Chair that the entire organization is a membership committee, each member endeavoring to enroll someone else in the engineering profession as a member.

Messrs. Conkright and Oelschlager, International Harvester Co., Milwaukee, spoke on the Diesel engine. Mr. Oelschlager pointed out the fact that the parts on the injection pump are held to tolerances almost beyond human imagination on a production basis.

We wish to thank Mr. Clifford Dussault, International Harvester Co., of Milwaukee, for his able assistance in arranging this program.

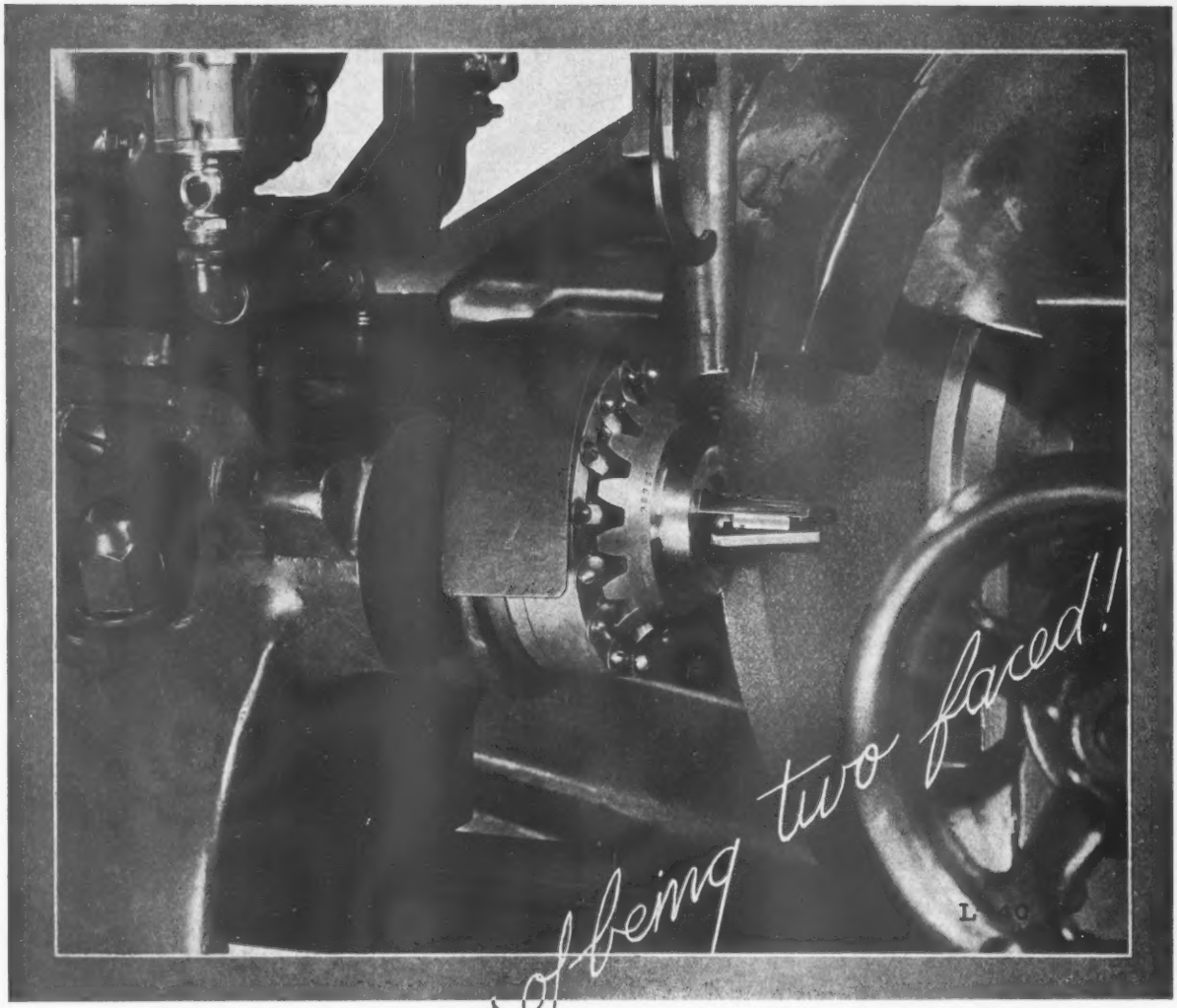
RACINE

T. J. Santry, Chapter Publicity Chairman, 1615 Racine Street, Racine

The regular monthly dinner meeting of the Racine Chapter, American Society of Tool Engineers, was held Monday night, March 15th at 6:30 P.M. at Hotel Racine.

The principal speaker of the evening was Mr. L. B. Augustine, Sales Manager of the Dumore Electric Company of Racine, Wisconsin. During his talk, he covered thoroughly, the design and construction of high speed precision grinders, manufacturing methods used to get accuracy and efficiency from same, and features of the tools. He explained that the abraisive wheel on high speed grinding tools is similar to a cutter on a milling machine or tool on a lathe in that the stock removed when magnified shows that the fine particles are chips. During his talk he also dwelt at length on the manufacture of the type of motor required to drive this tool. He stated it had to be built to the highest degree of balance and accuracy in order to eliminate any vibration to drive the grinders at their maximum speed. He also brought up the point that as far as tools are concerned, the high speed grinding tool is about the only tool that is entirely an American development. Photographs and charts were on display, showing some unusual set-ups and applications, and at the close of the meeting, Mr. Augustine answered a number of questions asked by the engineers and guests.

The meeting was well attended, there being 100 engineers,and guests present.



Persons who are two-faced are usually shunned. But being two-faced can lead to popularity.

The Landis Type C Hydraulic Side Gear Grinder, with its semi-automatic features and its two-faced grinding wheel, has certainly not been shunned by keen production men in the automotive field. There is small wonder that it has become popular. Production has been increased as much as from 60 to 160 gears per hour. Concentricity of the hub with the face has been assured. One operation has taken the place of two operations.

There are numerous other precision grinding operations that would handsomely benefit the manufacturer as a result of this same two-faced treatment.

Landis Tool Co.
Waynesboro, Pa.

221

THE SMARTEST INVESTMENT ANY MANUFACTURER CAN POSSIBLY MAKE IS IN MODERN MACHINE TOOLS.

Designing Special Machines

(Continued from page 12)

the particular parts are to be made to arrive at a fair cost.

I have found that by dividing the machine into small sections, estimating each section and then combining them, the cost will be more nearly correct than by estimating the whole machine as a unit. In order to estimate fairly accurately in this manner, it requires considerable experience and knowledge of costs of previous machines, and is really done by comparison rather than by any fixed cost formulae. This approximate cost should then be checked with the present or an anticipated activity of the work to be performed to determine whether the machine should be built or not. As products are constantly changing it is generally considered good policy not to figure more than two years to pay for a special machine, although this time limit may be extended, depending on the particular application and activity. As the cost of a special machine is higher than a standard machine, due to the whole cost of engineering and development being charged to one machine, it follows that the machine must be made as cheap as possible, with the proviso that it still does the operations required of it. This may be accomplished by fabricating most of the machine from structural steel angles, channels, H beams, steel plates, etc.

Points to Remember

Frames or beds of machines on which cutting tools are used need to be made heavier in order to get rigidity and prevent chatter, although for most machines it is possible to use a lighter structural steel frame. This also saves several weeks time waiting for patterns and castings, and costs much less when only one machine is being built. Any parts requiring machining and accuracy should be annealed after welding. Fabricated parts that are required to slide on each other must be faced or lined with cast iron or brass to eliminate seizure.

When machines are very long and have a number of different parts to be driven, it may be easier to drive them with individual motors than to run a line shaft the full length of the machine. Mechanically operated trips, etc., with their costly mechanisms may be eliminated by the use of electric eyes used to control magnets at any distance from the eyes. Where necessary on a machine, different A.C. motors may be run in synchronism. By using a Motor-Generator set with an adjustable speed D.C. motor and an A.C. generator, the speed of the motors may be varied by changing the speed of the D.C. driving motor and still keep the A.C. motors synchronized. When designing a long machine the frame should be designed so that it may be taken apart for moving to its location. It may have to be moved on elevators, etc., so the location and accessibility should be checked before the design is completed. No attempt has been made to describe any particular machine, as what applies to one machine generally does not apply to another one, also special movements, etc., shown in handbooks, have to be adapted and applied to suit the particular application by the design engineer.

Other Factors Involved

Considerable data is available in regard to cutting tools, speeds, feeds, etc., which are used on standard machines, but due to the nature of most special machines there is very little information available that can be used. Most of the information is the result of experimenting with the particular materials being used. A machine may function perfectly

(Continued on Page 40)

The NUMBER FIVE Besly Grinder

★

LOWERS COSTS IN THE TOOL ROOM AND ON THE ERECTING FLOOR

★

IDEAL FOR LIGHT MANUFACTURING

A Direct Connected Motor Driven Disc Grinder with sturdy 3 H.P. Motor and Push Button Control. Has spindle mounted in High Grade Ball Bearings and carries eighteen inch Besly Titan Steelbac Abrasive Discs. The famous Besly Geared Lever Feed Table has micrometer adjustment. Heavy Welded Steel Exhaust Type Guards and efficient Truing Device. You will be surprised at its reasonable price.

Write for your copy of Booklet on Besly Titan Steelbacs.

• Do you operate a Disc, Surface or Face Grinder employing the side of a Grinding Wheel? If so, get your copy of Booklet describing Besly Titan Steelbac Abrasive Discs. These bolted-on Discs with one, two and three inch of Resinoid Bonded Abrasive continue making new records against the older type of grinding member. Investigate.

CHARLES H. BESLY AND COMPANY

118-124 NORTH CLINTON STREET ★ CHICAGO, ILLINOIS

Designing Special Machines

(Continued from page 38)

one day and refuse to do so the next, due to temperature variations, humidity, static electricity and various other reasons. This makes designing and developing special machines very interesting, as there is always something new to develop or try to eliminate in order to make them function properly.

While the trend of these times is to specialize, the special machine design engineer has to generalize rather than specialize. This work requires a general knowledge in almost all the arts and also considerable research work in order to accomplish results. Quite a few engineers have their own home work shops where they make actual working models in order to be sure certain parts will operate successfully.

Sometimes things that figure all right on paper do not work that way, due to factors assumed that were not correct for that particular application for which they were used. This possibly shows the need for better analysis of what is required. Most college engineering graduates are capable of figuring exactly all the stresses, torque, etc., but very often they have not made the proper analysis, and therefore get the wrong answer. In other words, it is harder to properly state the problem than to work it after it has been stated. In view of the above it would seem that a special machine designer should have, in addition to a technical education, the following qualifications: (1) Analytical and inventive ability. (2) Broad general knowledge of machine tools. (3) Shop experience in building machine tools. (4) Perseverance and willingness to co-operate with others.

New Equipment

(Continued from Page 20)

Detroit Universal Duplicator

Giern & Anholtt Tool Company, 1312 Mt. Elliott, Detroit, Michigan, announce the Detroit Universal Duplicator—"a handy portable outfit movable from machine to machine wherever needed for duplication of work. The machine is capable of copying from pattern or matrix to close limits."

Detroit Universal Duplicator—Manufactured by Giern & Anholtt Tool Company, Detroit, Michigan

The "Duplicator" is connected by means of a universal shaft to any leadscrew, which controls the contour of the work, the machine's own power supplying the cross feed. It is claimed that this machine is powerful enough to operate any size boring mill and yet sufficiently sensitive to operate the smallest machine with accuracy.

Kirkland Roll Type Stud Setter

A new type Chuck is being introduced by the Arthur Kirkland Sales Co., 2832 East Grand Blvd., Detroit, Michigan. This Chuck is especially adapted for driving or extracting studs by gripping the unthreaded portion of the stud. It is adaptable to air motors, electric motors, drill press, or by hand.

Arthur Kirkland, member of the A.S.T.E., states that a patent has been granted to him for this device, after he "met and overcame interferences brought about by others who were trying to accomplish the same thing."

Detroit Speakers' Club Starts Second Term

The Detroit A.S.T.E. Speakers' Club has ended its first term. It, now, is starting its second term, under the direction of Mr. Harry Heffner, well known to members and friends of The Society in Detroit.

The new term is of ten weeks' duration, and a number of enrollments are still available. Weekly meetings are held on Tuesdays at 8:00 p.m. The enrollment fee is very nominal.

All members and friends are invited to join this class not only for the practice and experience to be gained in speaking, but for the good fellowship and recreation which we understand are prime attributes of the course. Address the A.S.T.E. offices, 5928 Second Boulevard, Detroit, for information.

W. MAXWELL GRAY

"Bill" Gray Ill

W. Maxwell (Bill) Gray, well known to A.S.T.Eers in many parts of the country, especially in the Detroit area, is critically ill at the Henry Ford Hospital in Detroit.

The news of his illness came as a distinct surprise to his many friends who have seen him until very recently, apparently in the "pink" of condition. "Bill," as he is affectionately known to A.S.T.Eers everywhere, has taken a very active part in the affairs of The Society particularly during the Machine Tool Show in September, 1935, when he handled the Steamer excursion when some eight hundred members attended the Machine Tool Show en mass via the chartered boat.

All join in wishing Bill a speedy recovery and extend to h'm the'r best wishes for an early return to his usual act vit es and friends.

WIRE-ATTACHED BEZEL. The Ames Shockless Gauge is assembled with wire attached bezel — no screws or lugs to cut or cause wear. The wire is easily removed and can be replaced with the fingers. For other distinctive features, send for the Ames Gauge catalogue.

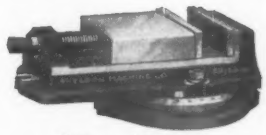
AMES *Shockless* GAUGES

B. C. AMES CO., Waltham, Massachusetts

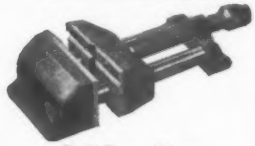
SHELDON

ARBOR PRESSES and VISES

Arbor Presses
12 Sizes
From ¾ to 10 ton Pressure



Plain and Swivel Milling Machine Vises
4 Sizes
3½ to 8½ inch Jaws

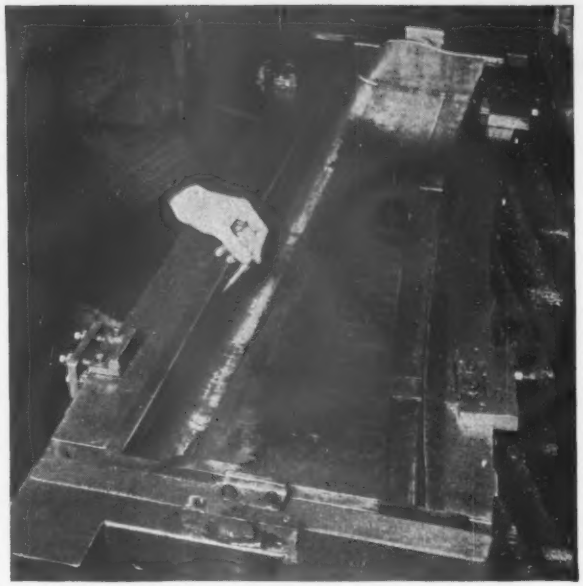


Drill Press Vises
3 Sizes
4½-6½ and 9 inch Jaws

Shaper Vises
2 Sizes
12 and 14 inch Jaws

Ask for No. 25 Catalog and Price List

SHELDON MACHINE CO.
3251 Cottage Grove Ave. Chicago, Ill.



GOOD FOR 40,000 STAMPINGS

• This machine shop, like many others, has found the "Toolweld" way to reclaim worn tools and dies. This particular die, used for stamping out car running boards, has been resurfaced with this easy-to-apply weld metal and is judged to last for 40,000 more operations.

Many shops are also using "Toolweld" for the building of their new tools and dies—with mild steel as a base—realizing enormous savings over the method of employing high-speed tool steel.

Here is opportunity for showing ingenuity and showing a saving in toolroom costs. Try "Toolweld!" Address—

THE LINCOLN ELECTRIC COMPANY
Dept. AE-349 **Cleveland, Ohio**
Largest Manufacturers of Arc Welding Equipment in the World

TOOLWELD

Cuts the cost of building and maintaining tools and dies

Design for Production

(Continued from Page 11)

the engineer. Great sums of money are constantly being expended in large plants to introduce new materials, new fabricated forms, or new manufacturing equipment to effect economies and promote sales. Particularly do small savings on each part manufactured in quantities yield profitable results.

As soon as the method of manufacture is agreed upon as exemplified by the routing, the plant is prepared for manufacture. Machine tools must be provided and arranged, and accessories must be designed and constructed.

Prints of those parts made from castings must be sent to the pattern shop where patterns are designed, constructed, and delivered to the foundry. Prints of parts made in presses or by forging or upsetting are sent to the die-design section where the designs are executed by specialists. The dies are then constructed in the tool room and die shop. Prints of parts requiring machining operations, with copies of routings of the part, are sent to the tool-design division where jigs, fixtures, and inspection gages are designed. Many times these jobs are turned over to specialized outside plants to be designed and constructed.

Again in the construction of these dies, jigs, gages, etc., standard materials are available for use to meet various requirements. Each plant usually standardizes on materials and methods as a result of its years of experience or upon the recommendations of reputable suppliers. The degree of elaboration of any design should depend upon the purpose for which it is intended. A large expenditure is justified in the face of large production. Frequently, however, special tools are required only because the job cannot be accomplished satisfactorily otherwise.

The above discussion of product development and planning for manufacturing, leads directly to the tools and accessories to be designed. The principles involved and the procedure of design for each is a subject by itself. (Conclusion)

Advertisers' Index

CONSIDER RESULTS!

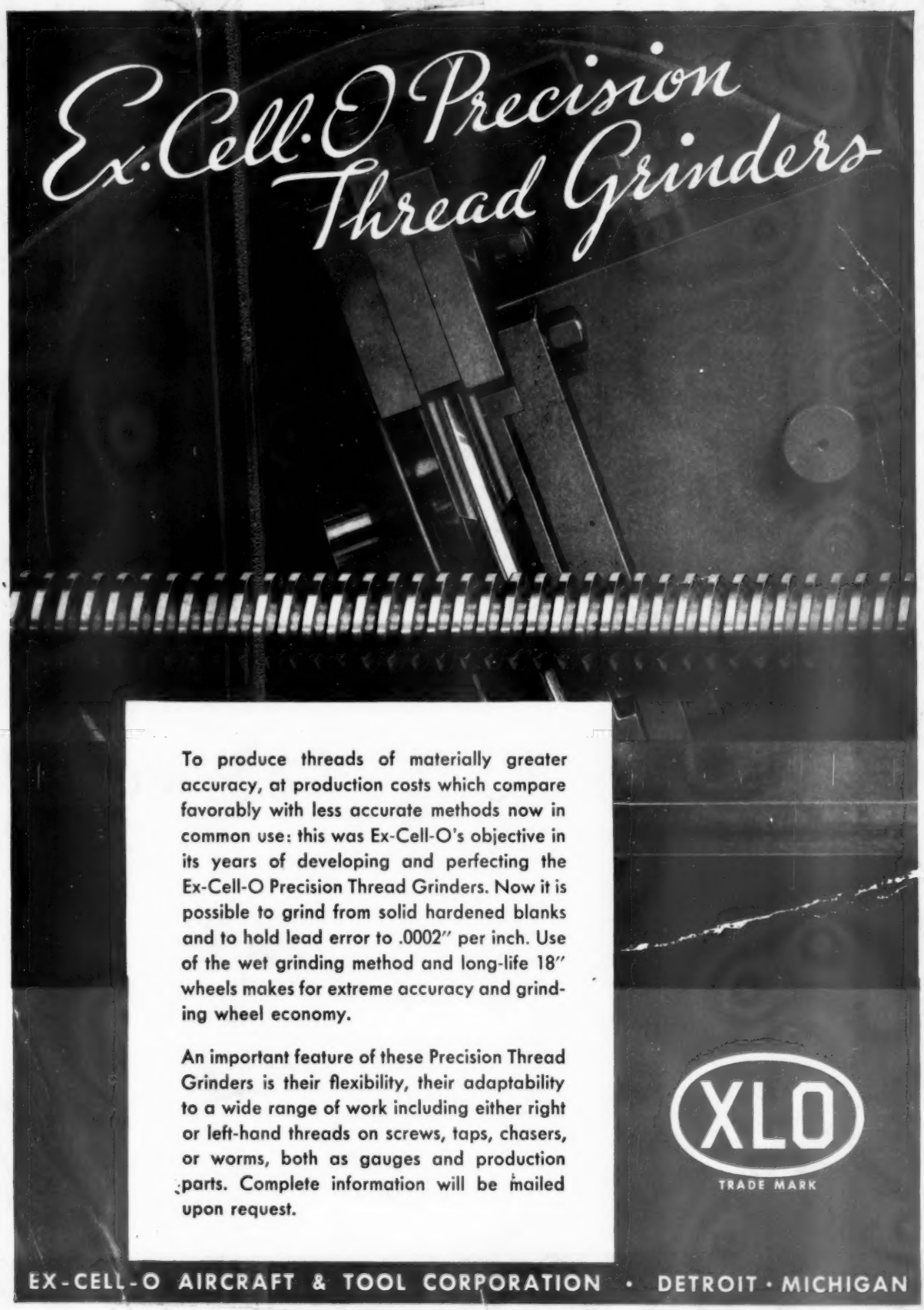
You can buy Brown & Sharpe Cutters with the knowledge that they will give you the **fullest return from your investment.**

Their performance is known wherever metal is worked. Through careful design and selection of materials, and uniformly skillful heat treatment, these cutters deliver a maximum number of cuts between sharpenings at a high rate of production, insuring the manufacturer the greatest production per cutter dollar.

B·S

It pays to have Brown & Sharpe Cutters on every job. We urge buying through the distributor. Brown & Sharpe Mfg. Co., Providence, R. I.

BROWN & SHARPE CUTTERS



To produce threads of materially greater accuracy, at production costs which compare favorably with less accurate methods now in common use: this was Ex-Cell-O's objective in its years of developing and perfecting the Ex-Cell-O Precision Thread Grinders. Now it is possible to grind from solid hardened blanks and to hold lead error to .0002″ per inch. Use of the wet grinding method and long-life 18″ wheels makes for extreme accuracy and grinding wheel economy.

An important feature of these Precision Thread Grinders is their flexibility, their adaptability to a wide range of work including either right or left-hand threads on screws, taps, chasers, or worms, both as gauges and production parts. Complete information will be mailed upon request.

XLO
TRADE MARK

EX-CELL-O AIRCRAFT & TOOL CORPORATION · DETROIT · MICHIGAN